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Fourth Edition.

MATERIA MEDICA, BOTANY, CHEMISTRY, PHARMACY, PRESCRIPTIONS, AND PRACTICAL DISPENSING.

F. HARWOOD LESCHER.

AN

INTRODUCTION

TO THE

ELEMENTS OF PHARMACY

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AN INTRODUCTION

TO THE

ELEMENTS OF PHARMACY:

A GUIDE

TO THE

PRINCIPAL POINTS

IN

MATERIA MEDICA, BOTANY, CHEMISTRY, PHARMACY.
AND PRESCRIPTIONS.

BY

F. HARWOOD LESCHER,

PEREIRA MEDALLIST.

FOURTH EDITION.

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TO

JOHN JAMES EVANS, ESQ.,

AS A MARK OF ADMIRATION FOR HIS CHARACTER, AS A

TRIBUTE OF RESPECT TO HIS QUALITIES,

AND IN REMEMBRANCE OF MANY PLEASANT HOURS

SPENT TOGETHER IN FORMER YEARS,

THESE PAGES ARE AFFECTIONATELY DEDICATED,

BY HIS SINCERE FRIEND,

THE AUTHOR.

September, 1872.

PREFACE.

THIS work is an *aperçu* of the six subjects generally read up during a curriculum of "Pharmacy."

Its essential character is the columnar or tabular arrangement; this may be considered as the natural consequence of a fixed idea as to the value, in the pursuit of such important studies, of a *systematic* classification of the several divisions of a subject.

The introduction to the Elements of Pharmacy is intended as a guide to the salient points in the six departments of study, and to act also as an aid to the remembrance of the main heads of what may have been the objects of a course of lectures; and, by exciting the interest of the student, to induce him to devote more time and attention to practical experiment and to serious study. Its aim may be given in two words—suggestions to the mind; assistance to the memory.

The standard text-books have been to a certain degree followed by the author: among those works that have been more especially referred to, may be mentioned Pereira's "Materia Medica," Bentley's "Manual of Botany," Redwood and Möhr's "Practical Pharmacy," Attfield's "Chemistry," Squire's "Companion," Fowne's "Manual of Chemistry," &c. The author also has to offer his most sincere thanks to those friends who have given him help in the collection of information, and more especially to one who has most materially lightened his labours by his valuable assistance in the correction of the proof-sheets of the work.

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[*The figures in parentheses in the sections of Materia Medica, Botany, Chemistry, and Pharmacy refer to the several numbered Specimens in the Cabinets published by* MESSRS. EVANS & CO., 60, Bartholomew Close, London, *and by* MESSRS. EVANS, SONS, & CO., Liverpool, *to accompany this Work. Prices,* £7 7*s*. 0d *and* £4 4*s*.]

INTRODUCTION.

The intention of the following pages is to give an outline of those subjects which, grouped together, constitute the science of Pharmacy. As Medicine, taken in its comprehensive term, is considered as including different sciences, and several separate branches of study, so do we, with an equal right, claim for Pharmacy the same extension and the same comprehension of more than one branch of learning. Not only do we rank under Pharmacy the active pursuit of the manipulative operations of the laboratory, but we likewise assert the right to include under this name the various divisions of study that serve to the more perfect acquaintance with the properties of the many substances employed, or to the more accurate knowledge of the transformations that come under notice. And whilst we wish to raise Pharmacy itself to a higher rank, whilst we desire to bring other sciences as tributaries to its feet, none the less is it our earnest wish to claim for the *student* of Pharmacy a higher intellectual position and a more extended field of study. The pursuit of Pharmacy, in the fullest sense of the word, takes within its grasp, besides manipulative skill in the operations of the laboratory, the theory and practice of Chemistry, Botany in its several divisions, Materia Medica with its many sections and ramifications.

In his treatment of these subjects, the author claims, not originality of matter—for, doubtless, each subject has been elsewhere more completely treated—but certainly originality of arrangement and of classification. The object of the present work has been to lay before the student a comprehensive and clearly-arranged bird's-eye view of these separate branches, and, at the same time that the necessity for serious study is insisted upon, the aim in view has more especially been to attract his interest, and to lead him to the pursuit of the several divisions of these sciences in fuller manuals and in more important text-books.

We wish now to say a few words on what we may consider as the *rational* study of Pharmacy; and, to illustrate our meaning, we will take as an example the study of the history of a nation. If we wished to pursue this study in as perfect a manner as possible, our idea would be not to plunge into Hallam, or Froude, or Macaulay, still less to rely solely on a chart, however complete and perfect; the rational plan would rather be to glance over the names of the monarchs, divide their reigns into epochs, and then, taking each reign by itself, to make oneself master of it, not only in its individual aspect, not only as one detached ring of a series, but especially in its relation to preceding and subsequent reigns; as to the extent also to which the principal events may be traced out as the effects of preceding and the causes of subsequent events; how far the proceedings of one period were connected with and depended on those taking place at the same time amongst other nations: then several reigns might be considered as a group, each group bearing some special features distinct from those of a different one; again, special subjects for study might be taken, and their development traced through several eras, depending upon and themselves often influencing successive chains of circumstances. Thus the same events and group of events are considered under different phases and from different points of view. The influence of literature might be traced from early to more recent times, and from the extent of certain ranges of thought at given periods might often be deduced the origin of series of incidents of the highest significance. The consideration of the gradual improvements in the industries of the several epochs, the growing power of the fine arts, the increase of refinement in the many branches of warfare, might in many cases have accounted for changes in the nation, in themselves insignificant, yet in their consequences of the greatest importance. Thus the study of a subject, pursued in this "collateral" manner, assumes not only an instructive, but a pre-eminently interesting aspect: moreover, the memory, having so many aids and landmarks, rapidly becomes retentive to the highest degree.

Let us urge that the same rational plan be adopted with regard to the study of Pharmacy.

After glancing through its several branches, and with a clear conception of the extent to be gone over, take Materia Medica, and make yourself thoroughly master of its essentials, and even in those specimens familiar to you, paying attention to any remarkable formation or peculiar characteristic. Then turn to Botany, not considering it as a separate subject, but with the endeavour to build up, on the already-acquired basis of Materia Medica, a structure of sound scientific knowledge of the formations and functions of the vegetable world. Then pass on to Chemistry; a clear conception of the laws which govern chemical action, and the characteristic properties of elementary and composite bodies will be found essential in the several divisions of analysis and synthesis, as exemplified in the preparation of the chemicals of the Pharmacopœia. Allied to Chemistry, and reared on its broad foundations, are the kindred branches of Pharmacy and Practical Dispensing; moreover, on Chemistry, combined with a knowledge of the Latin language, depends, in great measure, the perfection and success of Prescriptions, both as regards their composition and, more especially, as regards their accurate interpretation.

Botany and Chemistry, Chemistry and Pharmacy proper, touch and interlace at many points, and on many occasions help and explain each other. Materia Medica, in all its numerous ramifications, offers the most extensive field for observation, and may with truth be termed the focus of many converging scientific paths: here it embraces Zoology, there Entomology is pressed into its service; at one time Chemistry explains the gradual formation of many of the substances over which it has sway, and at another time it is Botany that derives a new interest and a fresh lustre from the many illustrations which it finds in the pages of this great and important branch of physical science. Thus is erected a structure of true and sterling knowledge, valuable in itself, beneficial in its results, and lasting in its influence on the mind of the student.

SECTION I.

MATERIA MEDICA.

PART I.—Characteristics of the Pharmacopœia Materia Medica.

[N.B.—In the first column, the French and Spanish names of the principal articles are given, under the geographical sources.]

[SEVERAL NON-OFFICINAL PLANTS ARE INSERTED IN PART I., IN BRACKETS.]

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
RANUNCULACEÆ.		
ACONITUM NAPELLUS. *Monkshood.* Europe. *Fr.* Aconit Napel. *Sp.* Aconito.	ROOT—Tapering rapidly, with fibrils. *Colour*—EXT. coffee-coloured. INT. yellowish brown. *Odour*—Faintly narcotic. *Taste*—Acrid; numbing. LEAVES—Large, much divided.	Narcotic; sedative. Aconitia. (Fig. 45.) (Fig. 209.)
PODOPHYLLUM PELTATUM. *Podophyllum.* North America. *Sp.* Podofilo.	RHIZOME—Long, thin, wrinkled, irregular, with rootlets. *Colour*—EXT. dark reddish brown. INT. whitish.	Purgative. Podophylline. (Fig. 54.) Resin. (Fig. 122.)
MAGNOLIACEÆ.		
ILLICIUM ANISATUM. *Star Anise.* China. *Fr.* Badiane. Anis-étoilé. *Sp.* Badiana.	FRUIT—A variable number of hard woody aromatic follicles, disposed in a star-like form, each containing an oval reddish seed. *Colour*—Reddish brown. *Odour*—Of anise.	Aromatic. Essential oil. (Fig. 224.)

CISSAMPELOS PAREIRA. *Pareira-brava.* South America. West Indies. *Fr.* Pareira-brava.	ROOT—In cut lengths, with apparent pith, and concentric zones; rough. *Colour*—Dark brown. *Taste*—Sweet, then bitter.	
JATEORHIZA CALUMBA. *Calumba.* Mozambique. Africa. *Fr.* Colombo. *Sp.* Colombo.	ROOT—Transverse sections of thick fleshy root, depressed in centre. *Colour*—EXT. dark brown. INT. bright yellow. *Taste*—Very bitter.	Demulcent; tonic. Calumbine. (Berberine.) (Fig. 9.)
PAPAVERACEÆ. PAPAVER SOMNIFERUM. *Garden Poppy.* Levant. Asia Minor. Turkey. Egypt. India. Persia. Europe. *Fr.* Pavot blanc et P. noir; Opium (d'Anatolie, dit de Smyrne). *Sp.* Adormiderma. Opio (de Esmirna.)	OPIUM—Inspissated juice. (α) Smyrna. Irregular masses, rounded or flattened; softish; made up of agglutinated tears. EXT. covered with poppy-leaves and rumex (dock) capsules. *Colour*—Reddish brown, changing to black. *Odour*—Heavy, narcotic; not *mouldy.* *Taste*—Acrid; nauseous. *Touch*—Waxy, *not* greasy. (β) Constantinople. Small hard cakes; less in value; less narcotic and more mucilaginous. (γ) Egypt. Inferior; hard. (None in commerce at present day) *Colour*—Reddish. *Odour*—Musty. (δ) Persian, European, Indian (for Chinese markets).	Three *successive* actions:— 1. Stimulant. 2. Depressing (to nerves). 3. Narcotic. **Morphia.** **Codeia.** **Meconic acid.** (Fig. 123.)
PAPAVER RHŒAS. *Red Poppy.* *Fr.* Coquelicot. *Sp.* Amapola.	DRIED FLOWERS—(*Petals*). *Fresh*—Bright red. *Dried*—Dull in colour. *Odour*—Faintly narcotic when recently gathered.	Little astringency; no anodyne properties. (Fig. 240.)

SECT. I.—**Materia Medica**—*continued.*

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
DOREMA AMMONIACUM. *Ammoniacum.* Persia. *Fr.* Gomme ammoniaque. *Sp.* Goma amoniaco.	OLEO-GUM-RESIN—In masses of separate tears, readily softening by heat. *Colour*—Pale yellowish brown. *Fracture*—Smooth, shining, opaque white. *Odour*—Peculiar, *sui generis.* *Taste*—Nauseous.	External stimulant. Volatile oil. Gum. Resin. (Fig. 60.)
CAPRIFOLIACEÆ. SAMBUCUS NIGRA. *Elder.* Indigenous. *Fr.* Sureau.	FLOWERS—In cymes of minute individual flowers. *Colour*—White. *Odour*—Pleasant.	Slight stimulant to weak constitutions. (Fig. 229.)
RUBIACEÆ (CINCHONACEÆ). CEPHAËLIS IPECACUANHA. *Ipecacuanha.* Brazil. *Fr.* Ipécacuanha annelé ou officinal. *Sp.* Bejuquillo.	ROOT—Irregular, rough, rounded, contorted, with annular depressions at frequent intervals. Some of the *smooth* stem adhering in many cases. *Size and Length*—Three to four inches in length, and size of small quill. *Colour*—EXT. brown-grey. The iron-grey is esteemed of superior quality to the lighter shades of brown. INT. whitish. In two portions. The cortical: active, brittle, pulverulent. The inner: inert, tough, woody. *Odour*—Disagreeable; apparently musty. *Taste*—Nauseous; somewhat acrid.	Expectorant; emetic. Emetina; vol. fat; resin. (Fig. 52.)
CINCHONA CALISAYA. *Yellow Bark.* Bolivia. South America. *Fr.* Quinquina calisaya; Q. jaune royal. *Sp.* Quina calisaya. ó amarilla (legitima)	BARK—Flat or quills. Size, twelve or less, by one to three inches; generally consisting simply of *liber*, or inner bark (derm), the two outer coats (periderm) having been removed. EXT.—Furrows, *longitudinal*, from growth of plant or drying of bark, if the outer coat has not been removed. *Colour*—EXT. brown. INT. tawny yellow. *Fracture*—Short; fibrous, but with fibres short, fine, not stringy or ligneous. *Taste*—Bitter, from quinine. Styptic, from acids. Slightly aromatic, from vol. oil. *Powder*—Cinnamon-brown.	Febrifuge. Quinia; kinic acid. (Fig. 36.)

Gossypium Herbaceum. *Cotton.* *Fr.* Coton. *Sp.* Algovon.	Hairs, surrounding seeds.	
BYTTNERIACEÆ. Theobroma Cacao. South America. West Indies. *Fr.* Cacao. *Sp.* Cacao.	Concrete Oil—Expressed from the seeds. Solid at ordinary temperatures; melts at 122° Fahr. *Colour*—Yellowish white. *Odour*—As chocolate. *Taste*—Little; no rancidity.	As a medium in Unguenta, &c. (Fig. 65*.)
AURANTIACEÆ. Citrus Bigaradia. *Seville Orange.* South of Europe. *Fr.* Bigaradier; Orange. *Sp.* Naranjo.	(α) Rind of Fruit—In thin sliced strips, dried. *Colour*—Bright yellow. *Odour*—Aromatic. *Taste*—Bitter. (β) Distilled Water. (γ) Essential Oil.	As flavouring; slightly tonic. Essential oil. α (Fig. 79.) β (Fig. 136.)
Citrus aurantium. *Sweet Orange.*	Distilled Water.	
Citrus Limonum. *Lemon.* Europe. *Fr.* Citronnier; Citron. *Sp.* Limon.	Succus—The juice; generally preserved with a small quantity of spirit. Rind of Fruit—Thin slices, dried. *Colour*—Pale yellow. *Odour*—Sharp; aromatic. *Taste*—Acid.	Antiscorbutic; as flavouring. Citric acid; essential oil. (Fig. 222.)
Ægle Marmelos. *Indian Baël.* India.	Fruit—Resembles, in shape and size, a pomegranate. Ext. hard, smooth rind. Int. many-celled. *Colour*—Yellow-brown. *Taste*—Astringent.	Astringent. Tannic acid (Fig. 43.)
GUTTIFERÆ. Garcinia Morella. *Camboge.* Siam. Ceylon. *Fr.* Gomme-gutte. *Sp.* Gutagamba.	Gum-resin—(α) in block; (β) in pipes. (β) run, originally, in the bamboo-cane; generally hollow in centre. Ext. rather rough, and often coated with a greenish dust. *Colour*—Orange, with bright smooth fracture, forming light yellow emulsion with water. *Taste*—Bitter; nauseous.	*Small doses*, drastic purgative. *Large doses*, irritant poison. (Fig. 27.)

SECT. I.—**Materia Medica**—*continued.*

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
ARNICA MONTANA. *Arnica.* *Sp.* Arnica.	ROOT-STOCK—Brown and fibrous.	Acrid stimulant. (Fig. 48.)
ANACYCLUS PYRETHRUM. *Pellitory.* Levant. *Fr.* Pyrèthre officinal. *Sp.* Parietaria.	ROOT—Fleshy when fresh, irregular when dry; cylindrical, furrowed; generally much worm-eaten; size of finger. *Colour*—EXT. dark brown. INT. yellow, with black specks. *Fracture*—Close; resinous. *Taste*—Pricking sensation, with heat.	Local irritant. (Fig.205.)
TARAXACUM DENS-LEONIS. (LEONTODON TARAXACUM.) *Dandelion.* Indigenous. *Fr.* Dent-de-Lion; Pissenlit. *Sp.* Taraxacon.	ROOT—Fleshy, large, tap-shaped, not tough, with yellow zones. *Colour*—EXT. tawny brown. INT. bright yellow. *Taste*—Sweet in winter, rather bitter in autumn, very bitter in spring and summer.	Stomachic tonic. Taraxin; sugar. (Fig. 206.)
LOBELIACEÆ.		
LOBELIA INFLATA. *Lobelia.* United States. *Fr.* Lobélie enflée. *Sp.* Lobelia.	FLOWERING HERB—Imported in oblong pressed packets, the whole green herb pressed together, generally having its seed-vessels. *Colour*—Greenish-yellowish. *Taste*—Acid; pungent.	Emetic; narcotic irritant. *In large doses*, poisonous. (Fig. 67.)
ERICACEÆ.		
ARCTOSTAPHYLOS UVA-URSI. *Bearberry.* Europe. Indigenous. *Fr.* Busserole; Raisin d'Ours. *Sp.*	LEAVES—Entire, shining, obovate, longish, with under surface reticulated. *Colour*—Dark green. *Taste*—Bitter astringent.	In bladder diseases. Tannic acid. (Fig. 82.)
STYRACEÆ.		
STYRAX BENZOIN. *Benjamin.* (α) Siam. (β) Sumatra.	BALSAMIC RESIN—(α) In tears or (β) in amygdaloid masses. (α) Finest quality. Tears, sometimes adhering. *Colour*—EXT. reddish yellow. INT. whitish yellow.	Local stimulant. Benzoic acid. α (Fig. 17.) β (Fig. 18.)

RUTA GRAVEOLENS. *Rue.* Indigenous. *Fr.* *Rue.* *Sp.* Ruda.	with oil-vessels. *Colour*—Pale yellow. *Odour*—Repulsive. *Taste*—Acrid-bitter.	Volatile oil.
SIMARUBACEÆ. (α) QUASSIA EXCELSA. (β) PICRÆNA EXCELSA. [*Formerly from* (a) *Quassia excelsa.*] *Quassia.* Jamaica. *Fr.* (a) Bois amer de Surinam. (β) Quassia de la Jamaïque. *Sp.* Cuasia amarga	WOOD—(α) no longer imported. (β) with or without bark; generally used as raspings. *Colour*—Whitish yellow. *Taste*—Extremely bitter.	Stomachic tonic. (Fig. 214.)
RHAMNACEÆ. RHAMNUS CATHARTICUS. Indigenous. *Fr.* Nerprun purgatif. *Sp.* Ramno Catartico.	BERRIES—Round, black, with mark of a cross on apex; four seeds. Sap-green when unripe, black-purple when ripe.	Violent cathartic. Bitter principle; colouring matter.
ANACARDIACEÆ. PISTACIA LENTISCUS. *Mastich.* Island of Scio, Levant. *Fr.* Lentisque (résine nommée *mastic.*) *Sp.* Amáciga.	RESIN—In tears, powdery from attrition; small in size. *Colour*—Light yellow. *Fracture*—Vitreous. *Odour*—Agreeable, increasing on application of heat. *Taste*—Slightly aromatic, softening on mastication (hence the latter word).	Used as a masticatory. (Fig. 63.)
AMYRIDACEÆ. BALSAMODENDRON MYRRHA. *Myrrh.* Arabia. Persian Gulf. *Fr.* Myrrhe. *Sp.* Mirra.	OLEO-GUM-RESIN—In tears, small; or in agglomerated nodules of various sizes. *Colour*—Reddish brown, with tendency to dark orange; oily veins of yellow and white in interior. *Fracture*—Dull and fatty; oily on pressure. In small tears the fracture is generally short. *Odour*—Little, but peculiar, and not unpleasant. *Taste*—Acrid; bitter; aromatic.	*In small doses*, stimulant. *In large doses*, irritant. Vol. oil; resin; gum. (Fig. 25.)
CANARIUM COMMUNE. *Elemi* (*probably*). Manilla. *Fr.* Élémi. *Sp.* Elemi. Resina de limon.	OLEO-RESIN—Soft mass, hard and brittle on drying. *Colour*—Whitish yellow, with (often) green points. *Odour*—Aromatic, resembling that of fennel.	Local external stimulant. Elemine (resin). (Fig. 235.)

SECT. I —**Materia Medica**—*continued.*

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
LEGUMINOSÆ— **Sub-order, MIMOSÆ.** ACACIÆ SPECIES VARIÆ. *Acacia.* (α) Levant, Arabia. (β) Barbary. (γ) Senegal. (δ) East Indies. *Fr.* (α) Gomme arabique vraie (γ) Gomme du Sénégal. *Sp.* Acacia verdadera. A. de Egipto.	GUM—(α) Turkey. Finest quality, in tears, clear, or opaque from numerous fractures. EXT. irregular, rough. INT. smooth; generally transparent. *Taste*—Viscid; insipid. (β) Barbary. Very inferior quality; dark and mixed with many impurities. (γ) Senegal. Used much in France; large pieces; hard. EXT. rough; "wrinkled." INT. conchoidal vitreous fracture. (δ) Rough. Many impurities, with air-cells in the nodules.	Demulcent; emollient. Gum. α (Fig. 1.) γ (Fig. 2.)
Sub-order, CÆSALPINEÆ. HÆMATOXYLON CAMPECHIANUM. *Logwood.* Honduras. Jamaica. *Fr.* Bois de Campêche. *Sp.* Leno campeche.	Dark red logs (or raspings).	Astringent. (Fig. 213.)
TAMARINDUS INDICUS. *Tamarind.* (α) East Indies. (β) West Indies. *Fr.* Tamarinier; Tamarin. *Sp.* Tamarindo.	(α) Shelled fruit from *short* pods, in hard mass, without sugar; dark brown. (β) Arranged in layers of *large* entire pods and sugar; stringy, with abundance of soft pulp. *Colour*—Reddish brown. *Taste*—Acid, but if sweetened, pleasant.	Gentle laxative. (Fig. 238.)
CASSIA OFFICINALIS. *Senna.* 1. C. LANCEOLATA (α) (CASSIA ACUTIFOLIA) C. OBOVATA (β) *Alexandrian Senna.* Egypt and Shores of Mediterranean. *Fr.* Séné d'Égypte. Séné palte. *Sp.* San de Alexand.	Alexandrian Senna. (α) Long leaf, mixed with (β) Shortish obovate leaf, with unequally oblique base. *Colour*—Silvery green. *Odour*—Resembling tea. *Taste*—Nauseous, bitter, slightly mucilaginous. FRUIT—A dry legume, thin and papery.	Mild purgative. Bitter extractive glucoside. Essential oil. (α) (Fig. 84.)

SCROPHULARIACEÆ.		
DIGITALIS PURPUREA. *Foxglove.* Indigenous. *Fr.* Digitale. *Sp.* Digital.	LEAVES—See Part IV. for description.	Depressant. Digitalin (glucoside). (Fig. 189.)
SOLANACEÆ.		
HYOSCYAMUS NIGER. *Henbane.* Indigenous. *Fr.* Jusquiame noire. *Sp.* Beleño.	For description, see Part IV.	Anodyne. Hyoscyamia. (Fig. 191.
ATROPA BELLADONNA. *Deadly Nightshade.* Indigenous. *Fr.* Belladonne. *Sp.* Belladona.	(α) LEAVES—As above. (β) ROOT—Branched, rough, brownish.	Narcotic poison. Atropia. α (Fig. 192.) β „ 7.)
DATURA STRAMONIUM. *Thorn-apple.* Indigenous. *Fr.* Stramoine. Pomme-épineuse. *Sp.* Estramonio.	LEAVES—As above. (Fig. 193.) SEED—Reniform; rough, flat. *Colour*—Brownish black. *Odour*—Peculiarly heavy when bruised. *Taste*—Feeble, nauseous, bitter.	Ditto. Daturia. (Fig. 193.)
SOLANUM DULCAMARA. *Bitter-sweet.* Indigenous. *Fr.* Douce-amère. *Sp.* Dulcamara.	DRIED YOUNG BRANCHES—Hollow, cylindrical. *Size*—Goose-quill. *Colour*—Yellowish green. *Taste*—Bitter, then sweet.	Diaphoretic. (Fig. 194.)
CAPSICUM FASTIGIATUM. *Capsicum.* Zanzibar. *Sp.* Pimiento.	FRUIT—Long, conical, shining pod. *Colour*—Orange-red. *Taste*—Pungent.	Irritant; stimulant; rubefacient. Capsicine. (Fig. 85.)
NICOTIANA TABACUM. *Tobacco.* America. *Fr.* Nicotiane; Tabac.	LEAVES—Long, brown, dried, with hairs. *Odour*—Heavy.	Narcotic. Nicotine. Volatile oil.

SECT. I.—**Materia Medica**—*continued.*

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
PTEROCARPUS SANTALINUS. *Sandal* (*red*). Ceylon. *Fr.* Santal rouge. *Sp.* Sandalo rubo.	WOOD—Raspings. *Colour*—Dark red. *Odour*—Faint.	For colouring. (Fig. 215.)
SAROTHAMNUS SCOPARIUS. *Broom.* Indigenous. *Fr.* Genêt.	TOPS OF PLANT—Green; peculiar odour when bruised.	Diuretic; aperient.
GLYCYRRHIZA GLABRA. *Liquorice.* Europe. *Fr.* Réglisse. *Sp.* Oruzuz ó Regaliz.	ROOT—Cylindrical; long. *Colour*—EXT. greyish brown. INT. yellowish. *Taste*—Sweet; mucilaginous.	Demulcent. (Fig. 204.)
PTEROCARPUS MARSUPIUM. *Kino.* Malabar. *Fr.* Kino de l'Inde. *Sp.* Quino.	GUMMY EXUDATION—Small angular pieces. *Colour*—Black by reflected, ruby-red by transmitted light, colouring the saliva *red.* *Fracture*—Shining; vitreous. *Taste*—Astringent.	Astringent; styptic. Tannic acid. (Fig. 249.)
ASTRAGALUS VERUS, &c. *Tragacanth.* Levant. *Fr.* Gomme adragante. *Sp.* Tragacanto.	GUMMY EXUDATION—In flakes; thin, flat, smooth, broad. *Colour*—White or cream-coloured, semi-transparent. Swells on addition of water into gelatinous mass.	Demulcent. Soluble gum. Insoluble gum. (Fig. 6.)
PHYSOSTIGMA VENENOSUM. *Calabar Bean.* Western Africa. *Fr.* Fève de Calabar. *Sp.* Habas de Calabar.	SEED—Irregular kidney-shaped, with two flat sides, and longitudinal furrow on convex margin. EXT. Hard, brittle, shining coat. INT. Two hard, pulverulent cotyledons. *Size*—Large horse-bean. *Colour*—EXT. Grey or brownish red. INT. White. *Taste*—None; neither acrid, bitter, nor aromatic.	(Fig. 216.)

Indigofera tinctoria. *Indigo.* India.	Blue Pigment, produced by the fermentation of the juices of the plant.	(Fig. 232.)
ROSACEÆ.		
(α) Rosa canina. Indigenous. *Fr*. Rose sauvage. *Sp*. Rosa.	(α) Fruit (*hips*)—Red, shining, enclosing many seeds.	Slightly astringent.
(β) Rosa gallica. Cultivated in Europe. *Fr*. Rose rouge.	(β) Petals—Purple-red, velvet; fragrant.	Feebly acid and bitterish astringent. (Fig. 239.)
(γ) Rosa centifolia. South Europe. *Fr*. Rose à cent feuilles.	(γ) Fresh ditto—Producing otto roses and dist. water.	
Brayera anthelmintica. *Kousso, or Cusso.* Abyssinia. *Fr*. Cousso. *Sp* Couso.	Flowering Herb—The entire plant, with flowers, tied up in bunches or rolls. *Colour*—Reddish brown, with remains of pink flowers. *Odour and Taste*—Faint.	Anthelmintic. (Fig. 41.)
Amygdalus communis. (α) *Var*. dulcis. South Europe. *Fr*. Amande douce. *Sp*. Almendra dolce. (β) *Var*. amara. Mogadore, &c. *Fr*. Amande amère. *Sp*. Almendra armaga.	Seed. (α) Enveloped in three coats, of which the "shell" is the inner one. "Jordan," long and thin, divisible into two portions. *Colour*—Ext. brown. Int. white. Some varieties are thicker and rougher. (β) Small and angular. *Odour*—Very powerful of prussic acid, if rubbed up with a little water.	(α) Fixed oil. (Fig. 225.) (β) Fixed oil; emulsine; amygdalin.(Fig. 134.) Amygdaline, a glucoside, in presence of emulsine (or synaptase) separates into hydrocyanic acid, bitter-almond oil and glucose.
Prunus domestica. *Prune.* South Europe. *Fr*. Prunier; Pruneau noir.	Dried drupes of the plum.	Gentle laxative.
Prunus Lauro-Cerasus. *Cherry Laurel.* *Fr*. Laurier-cerise. *Sp*. Lauroceraso.	Leaves—Elliptical, short-stalked, coriaceous, shining, toothed, with glands at base.	Diffusive stimulant. Hydrocyanic acid.

SECT. I.—**Materia Medica**—*continued.*

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle*
RICINUS COMMUNIS. *Castor Oil.* East Indies. America. South Europe, &c. *Fr.* Ricin; huile de ricin. *Sp.* Ricino; aceite de ricino.	OIL—Expressed from seeds; cold drawn thick and viscid. The *best* is colourless, tasteless, and without smell; the *ordinary* has pale straw-colour, nauseous smell, and acrid taste.	Laxative purge.
PIPERACEÆ.		
PIPER NIGRUM. *Black Pepper.* Java, &c. *Fr.* Poivre noir. *Sp.* Pimienta negra.	UNRIPE FRUIT (termed berries)—Small, round, rough exteriorly, shrivelled. On removing the "coat," white pepper produced. *Colour*—Black. *Odour and Taste*—Aromatic.	Spice. Resin; piperine. (Fig. 72.)
CUBEBA OFFICINALIS. *Cubebs.* Java, &c. *Fr.* Cubèbe. Poivre à queue. *Sp.* Cubeba.	UNRIPE FRUIT—Small, round, with network of reticulations; on stalk more than its own length. *Colour*—Black. *Odour*—Characteristic. *Taste*—Camphoraceous.	In diseases of the urethra. Cubebine. (Fig. 86.)
ARTANTHE ELONGATA. *Matico.* Peru. *Fr.* Matico. *Sp.* Matico.	LEAF—Thickish, entire, reticulated on under surface. *Colour*—Dull yellowish green. *Odour*—When fresh, aromatic.	As a mechanical styptic. (Fig. 68.)
CANNABINACEÆ.		
CANNABIS SATIVA. *Indian Hemp* (*Guaza*). India. *Fr.* Chanvre de l'Inde (Hachisch). *Sp.* Cañamo.	DRIED FLOWERING TOPS OF THE FEMALE PLANTS, *Cannabis sativa*, with flowers and fruit, if possible. *Colour*—Dull green. *Odour*—Peculiar.	Narcotic; neurotic. Resin.
HUMULUS LUPULUS. *Hop.* Indigenous. *Fr.* Houblon. *Sp.* Lupulo.	DRIED FRUIT (strobile) of female plant. Composed of scales, dry and coriaceous, with at base minute yellow grains of *lupuline*.	Stomachic tonic. Bitter extractive. Lupulin. (Fig. 223.)

	Colour—Yellowish green. *Odour*—Pleasant; aromatic. *Taste*—bitter.		
MORACEÆ. FICUS CARICA. *Fig.* Europe. *Fr.* Figue.	DRIED FRUIT—Brown; sweet; dried by exposure to sun and air.	Demulcent laxative.	
MORUS NIGRA. *Mulberry.* Europe. *Fr.* Murier noir.	FRUIT—An aggregation of small drupes. *Colour*—Dark purple-black. *Taste*—Acid; sweet.		
ULMACEÆ. ULMUS CAMPESTRIS. *Elm.* Indigenous. *Fr.* Orme champêtre. *Sp.* Olmo.	BARK—Broad thin pieces; tough and fibrous. *Colour*—Brownish yellow. *Taste*—Bitter and astringent.	Mucilaginous astringent.	(Fig. 221.)
CUPULIFERÆ. QUERCUS PEDUNCULATA. *Oak.* Indigenous. *Fr.* Chêne. *Sp.* Roble.	BARK—Dried; fibrous and brittle. (Bark of small branches and young stems.) *Colour*—EXT. brownish grey. INT. cinnamon-brown. *Taste*—Astringent.	Astringent. Tannic acid.	(Fig. 220.)
QUERCUS INFECTORIA. *Oak, bearing Galls:* (Diplolepis Gallæ tinctoriæ.) Europe. Asia. *Fr.* Noix de Galle d'Alep. *Sp.* Agalla.	GALLS—Excrescences caused by punctures and deposited ova; hard, heavy, round bodies; smooth, with short fracture. *Colour*—Bluish green or grey. *Taste*—Very astringent.	Astringent. Tannic acid. Gallic acid.	(Fig. 28.)
LIQUIDAMBARACEÆ. LIQUIDAMBAR ORIENTALE. *Styrax.* Levant. *Fr.* Styrax liquide. *Sp.* Estoraque (líquido).	BALSAM—1st, In a rough state, as liquid storax; grey, opaque, viscid. (Also as S. calamita, a brown pulverulent mass.) 2nd, Prepared by straining. Pellucid, semi-fluid. *Colour*—Brownish yellow. *Odour*—Fragrant, resembling Bals. Peru.	Local stimulant. Cinnamic acid.	(Fig. 242.)

SECT. I.—**Materia Medica**—*continued.*

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
PINACEÆ (CONIFERÆ).		
JUNIPERUS SABINA. *Savin.* *Fr.* Sabine. *Sp.* Sabina.	For description, see Part IV.	Irritant. Essential oil. (Fig. 197.
JUNIPERUS COMMUNIS. *Juniper.* Indigenous. *Fr.* Génièvre; Bais de génièvre. *Sp.* Enebro.	BERRIES (properly a galbulus)—Small, round, smooth. *Colour*—Blue-black, with a bloom. *Odour*—Pleasant. *Taste*—Sweetish. ESSENTIAL OIL—White; aromatic. [RESIN—Sandrach, or "Gum Juniper." From *Callitris quadrivalvis* (Mogadore), a large hard-wooded tree. Yellow drops; brittle; resembling mastiche.]	Diuretic; as a flavour. Volatile oil. (Fig. 227.) (Fig. 62.)
ABIES EXCELSA. *Spruce Fir.* Switzerland (?).	Producing Burgundy Pitch.	
ABIES BALSAMEA. Canada.	Producing Canada Balsam; pale yellow, ductile, semi-fluid oleo-resin, with peculiar odour.	(Fig. 243.)
PINUS TÆDA ET PALUSTRIS. North America.	Producing Frankincense, or "Thus."	(Fig. 236.)
LILIACEÆ.		
URGINEA SCILLA. (SCILLA MARITIMA.) *Squill.* Levant. *Fr.* Scille. *Sp.* Escila.	BULB—Sliced and dried; originally of large size, with fleshy inner scales; thick and juicy. *Colour*—Yellowish white. *Taste*—Acrid; bitter.	Expectorant; emetic. Acrid juice. (Fig. 3.)

(*α*) ALOE SOCOTRINA. *Socotrine Aloes.* Isle Socotra and neighbouring districts. *Fr.* Aloès sucotrindrai. *Sp.* Acibar sucotrino vero.	INSPISSATED JUICE OF LEAF—(*α*) Imported in casks and boxes, often mixed with "Hepatic." In irregular-sized pieces; dried. Translucent, if in flakes. *Fracture*—Shining; resinous. *Colour*—Brilliant garnet-red. *Odour*—Aromatic. *Taste*—Bitter, but slightly aromatic.	Purge. Aloine. Resin.	*α* (Fig. 31.)
(*β*) [*Hepatic Aloes.*]	(*β*) [As Socotrine, but opaque, not translucent. *Colour*—Dull liver; yellowish brown.]		*β* (Fig. 32.)
(*γ*) ALOE BARBADENSIS. *Barbadoes Aloes.* Barbadoes and West Indies. *Fr.* Aloès barbade. *Sp.* Acibar de las Barbadas.	(*γ*) In gourds. Dull opaque mass. *Fracture*—Conchoidal, or showing numerous shell-like marks. *Colour*—Rich reddish brown or yellowish brown.		*γ* (Fig. 30.)
[(*δ*) ALOE LUCIDA. *Cape Aloes* (not officinal). Cape of Good Hope.] *Fr.* Aloès du Cap; *vulgò*, Aloès sucotrin. *Sp.* Acibar del Cabo. (A. suc)	(*δ*) [Bright bottle-green mass, red by transmitted light, softish in hot weather. *Fracture*—Glass-like. *Odour and Taste*—Very nauseous. *Powder*—Yellow.]		*δ* (Fig. 33.)
MELANTHACEÆ. COLCHICUM AUTUMNALE. *Colchicum.* Indigenous. *Fr.* Colchique. *Sp.* Colquico.	CORM—If fresh, size of chesnut; fleshy, with two coats; generally dried in slices; flat, solid, and pulverulent. *Colour*—EXT. reddish brown. INT. opaque white. *Taste*—Bitter.	Narcotico-acrid. Colchicine.	(Fig. 199.)
	SEEDS—Small, brown, hard; *not* oily, but acrid.		(Fig. 121.)
VERATRUM VIRIDE. *Green Hellebore.* North America. *Sp.* Eleboro verde.	RHIZOME AND ROOTS.—Cylindrical, with numerous fibrils.	Veratria.	(Fig. 57.)

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
ARNICA MONTANA. *Arnica.* *Sp.* Arnica.	ROOT-STOCK—Brown and fibrous.	Acrid stimulant. (Fig. 48.)
ANACYCLUS PYRETHRUM. *Pellitory.* Levant. *Fr.* Pyrèthre officinal. *Sp.* Parietaria.	ROOT—Fleshy when fresh, irregular when dry; cylindrical, furrowed; generally much worm-eaten; size of finger. *Colour*—EXT. dark brown. INT. yellow, with black specks. *Fracture*—Close; resinous. *Taste*—Pricking sensation, with heat.	Local irritant. (Fig.205.)
TARAXACUM DENS-LEONIS. (LEONTODON TARAXACUM.) *Dandelion.* Indigenous. *Fr.* Dent-de-Lion; Pissenlit. *Sp.* Taraxacon.	ROOT—Fleshy, large, tap-shaped, not tough, with yellow zones. *Colour*—EXT. tawny brown. INT. bright yellow. *Taste*—Sweet in winter, rather bitter in autumn, very bitter in spring and summer.	Stomachic tonic. Taraxin; sugar. (Fig. 206.)
LOBELIACEÆ.		
LOBELIA INFLATA. *Lobelia.* United States. *Fr.* Lobélie enflée. *Sp.* Lobelia.	FLOWERING HERB—Imported in oblong pressed packets, the whole green herb pressed together, generally having its seed-vessels. *Colour*—Greenish-yellowish. *Taste*—Acid; pungent.	Emetic; narcotic irritant. *In large doses*, poisonous. (Fig. 67.)
ERICACEÆ.		
ARCTOSTAPHYLOS UVA-URSI. *Bearberry.* Europe. Indigenous. *Fr.* Busserole; Raisin d'Ours. *Sp.*	LEAVES—Entire, shining, obovate, longish, with under surface reticulated. *Colour*—Dark green. *Taste*—Bitter astringent.	In bladder diseases. Tannic acid. (Fig. 82.)
STYRACEÆ.		
STYRAX BENZOIN. *Benjamin.* (α) Siam. (β) Sumatra.	BALSAMIC RESIN—(α) In tears or (β) in amygdaloid masses. (α) Finest quality. Tears, sometimes adhering. *Colour*—EXT. reddish yellow. INT. whitish yellow.	Local stimulant. Benzoic acid. α (Fig. 17.) β (Fig. 18.)

à odour de vanille. (β) Benjoin de Sumatra amygdaloïde. *Sp*. Benjui.	with heat. (β) Usual quality of commerce. Large masses, white amygdaloid or mottled purplish brown, with white granite-like markings. *Odour*—Fragrant. *Taste*—Hot.	
OLEACEÆ. OLEA EUROPÆA. *Olive.* South Europe. *Fr*. Olivier; Olive. *Sp*. Oliva.	OIL—Pale yellow; thin, limpid. *Odour*—Little, but peculiar. *Taste*—Bland. (Not a drying oil.)	Demulcent. Oleic acid. Margaric acid. Glycerine.
FRAXINUS ORNUS ET ROTUNDIFOLIA. *The Ash, giving Manna.* Sicily. *Fr*. Manne (en larmes). *Sp*. Maña	Exudation from incised tree. Soft, pearly flakes, about six inches long. Porous, friable, incurved. Inferior sorts in mass, of dirty colour. *Colour*—Cream-white. *Odour*—Faint. *Taste*—Sweet; mawkish.	Gentle laxative. Mannite (60 to 80 per cent.). (Fig. 237.)
ASCLEPIADACEÆ. HEMIDESMUS INDICUS. *Indian Sarsaparilla.* India.	ROOT—Knotted, long, tortuous, annulated, with transverse and longitudinal furrows. EXT. cork-like brown cortical portion. INT. woody. *Colour*—Brown. *Odour*—Pleasant; like sassafras. *Taste*—Feeble sweet-bitter.	Alterative. (Fig. 51.)
LOGANIACEÆ. STRYCHNOS NUX-VOMICA. *Nux vomica.* India. *Fr*. Noix vomique. *Sp*. Nuez vómica.	SEED—Convex on one side, concave on the other; round, flat. Diameter, one inch. EXT. thin coating, covered with soft hairs. INT. tough, horny. *Colour*—EXT. ash-grey. INT. partially translucent, in thin slips. *Taste*—Extremely bitter.	Acts on brain, spine, nerves. Strychnine; brucine. (Fig. 29.)
GENTIANACEÆ. GENTIANA LUTEA. *Gentian.* Europe. *Fr*. Gentiane. *Sp*. Genciana.	ROOT—Branched, rugged, irregular. EXT. brown, with transverse furrows. INT. two yellow portions, separated by reddish line or zone. *Taste*—Bitter.	Tonic. (Fig. 8.)

SECT. I.—**Materia Medica**—*continued.*

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
OPHELIA CHIRATA. *Chiretta.* India.	PLANT—Long, smooth, branched. *Colour*—Pale brown. *Taste*—Very bitter.	(Fig. 69.)
CONVOLVULACEÆ.		
EXOGONIUM PURGA. *Jalap.* Mexico. *Fr.* Jalap tubéreux ou officinal. *Sp.* Jalapa.	TUBEROSE ROOT—Bullet-shaped or oval; heavy, dense; larger tubers often sliced or divided. *Size*—From nut to orange. EXT. warty, shrivelled, covered with thin cuticle. INT. yellowish grey, with zones of resinous matter. *Colour*—Dark brown. *Odour*—Nauseous. *Taste*—Disagreeable. [It is said on good authority that the "Vera Cruz" is the wild, the "Tampico" (Fig. 20) mostly the cultivated plant. The same inferiority is seen in the latter that is remarked in cultivated Rhubarb.]	Resin. (Fig. 19.) Jalapin, Convolvulin (glucosides).
CONVOLVULUS SCAMMONIA. *Scammony.* (α) Smyrna Scam. (β) Aleppo Scam. Levant. *Fr.* (α) Scammonée d'Alep. (β) ,, de Smyrne. *Sp.* Escamonea de Alepo y Esmirna.	GUM-RESIN, from incised root. (α) Smyrna (or Virgin), amorphous, irregular pieces, light, and often with air-cells. Contains 80 to 90 per cent. pure resin. *Fracture*—Resinous, shining, black; breaks in splinters; forms milk-like emulsion with the saliva. *Colour*—Ash-grey. *Odour*—Resembling that of old cheese. *Taste*—Peculiar; not agreeable. (β) "Aleppo" (Fig. 66*) often contains 50 per cent. or more of impurities.	Drastic purge. Resin. (Fig. 66.)
	ROOT—Tap-shaped.	As above. (Fig. 14.)
LABIATÆ.		
LAVANDULA VERA *Sp.* Espliego Alhucema.	Lavender. *Fr.* Lavande officinale	Indigenous.
MENTHA VIRIDIS	Spearmint. ,, Menthe verte	Indigenous.
,, PIPERITA *Sp.* Menta piperitas.	Peppermint. ,, ,, poivrée	Indigenous.
ROSMARINUS OFFICINALIS *Sp.* Romero.	Rosemary. ,, Romarin	South of Europe.

SCROPHULARIACEÆ. DIGITALIS PURPUREA. *Foxglove.* Indigenous. *Fr*. Digitale. *Sp*. Digital.	LEAVES—See Part IV. for description.	Depressant. Digitalin (glucoside). (Fig. 189.)
SOLANACEÆ. HYOSCYAMUS NIGER. *Henbane.* Indigenous. *Fr*. Jusquiame noire. *Sp*. Beleño.	For description, see Part IV.	Anodyne. Hyoscyamia. (Fig. 191.
ATROPA BELLADONNA. *Deadly Nightshade.* Indigenous. *Fr*. Belladonne. *Sp*. Belladona.	(α) LEAVES—As above. (β) ROOT—Branched, rough, brownish.	Narcotic poison. Atropia. α (Fig. 192.) β ,, 7.)
DATURA STRAMONIUM. *Thorn-apple.* Indigenous. *Fr*. Stramoine. Pomme-épineuse. *Sp*. Estramonio.	LEAVES—As above. (Fig. 193.) SEED—Reniform; rough, flat. *Colour*—Brownish black. *Odour*—Peculiarly heavy when bruised. *Taste*—Feeble, nauseous, bitter.	Ditto. Daturia. (Fig. 193.)
SOLANUM DULCAMARA. *Bitter-sweet.* Indigenous. *Fr*. Douce-amère. *Sp*. Dulcamara.	DRIED YOUNG BRANCHES—Hollow, cylindrical. *Size*—Goose-quill. *Colour*—Yellowish green. *Taste*—Bitter, then sweet.	Diaphoretic. (Fig. 194.)
CAPSICUM FASTIGIATUM. *Capsicum.* Zanzibar. *Sp*. Pimiento.	FRUIT—Long, conical, shining pod. *Colour*—Orange-red. *Taste*—Pungent.	Irritant; stimulant; rubefacient. Capsicine. (Fig. 85.)
NICOTIANA TABACUM. *Tobacco.* America. *Fr*. Nicotiane; Tabac.	LEAVES—Long, brown, dried, with hairs. *Odour*—Heavy.	Narcotic. Nicotine. Volatile oil.

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
POLYGONACEÆ. RHEUM [PALMATUM, &c.] *Rhubarb.* Tartary and Thibet; (α) *viâ* China and India; (β) *viâ* Russia; (γ) European. *Fr.* (α) Rhubarbe de Chine. (β) R. de Moscovie. (γ) Rhapontic. *Sp.* (α) Ruibarbo. (γ) Rapontico.	ROOT—(α) known as "East Indian." Dried, decorticated. Large, irregular, heavy pieces (not spongy), round or flat (the root divided in centre), often with bored hole and remains of string; gritty when under the teeth. *Colour*—EXT. yellow, with darker marks. INT. bright, marbled with fine waving grey and red lines. *Odour and Taste*—Peculiar, and not unpleasant to many. (β) known as "Russian" or "Turkey." Not now imported. The nearest approach to it is the "trimmed" China variety. (γ) Inferior; of little value.	Purge, but not drastic. Gentle purgative and stomachic. Rhein; resin. (Fig. 11.) (α Fig. 12.) (γ Fig. 13.)
MYRISTICACEÆ. MYRISTICA OFFICINALIS. *Nutmeg.* East Indies, Malayan Archipelago. *Fr.* Muscade. *Sp.* Nuez Moscada.	KERNEL OF SEED—Oval, furrowed, heavy, one inch in length. *Colour*—EXT. dark brown. INT. marbled with greyish brown and red. *Odour and Taste*—Aromatic and bitter.	Aromatic. Essential oil. (Fig. 24.)
THYMELACEÆ. DAPHNE MEZEREUM ET LAUREOLA. *Mezereon.* Indigenous. *Fr.* Mézéréon. Garou [D. Gnidium].	BARK—In quills, tough, pliable, fibrous. *Colour*—EXT. dark brown. INT. yellowish. *Odour*—Curious; unpleasant. *Taste*—Hot; persistently acrid.	Alterative. Acrid resin. (Fig. 77.)
LAURACEÆ. CAMPHORA OFFICINARUM. *Camphor.* China, &c. *Fr.* Camphre (du Japon). *Sp.* Alcanfor.	CONCRETE VOLATILE OIL—Solid, in crystalline tough white grains; in semi-transparent cakes. *Touch*—Soft; soapy. *Odour*—Powerful. *Taste*—Pungent, becoming cool.	Acrid antispasmodic. (Fig. 241.)

SASSAFRAS OFFICINALE. *Sassafras.* North America. *Fr.* Sassafras. *Sp.* Sasafrae.	ROOT—Sliced. Incurved pieces, with firm texture and well marked with zones. *Colour*—Brownish red or grey-yellow. *Odour*—Penetrating.	Stimulant; sudorific. Volatile oil. (Fig. 210.)
NECTANDRA RODIÆI. *Bebeeru* (*Greenheart*). British Guiana.	BARK—Large heavy pieces, 1 to 2 feet long. *Colour*—EXT. grey-brown. INT. dark brown. *Taste*—Bitter and astringent.	Tonic; febrifuge antiperiodic. Beberia. (Fig. 219.)
CINNAMOMUM ZEYLANICUM. Ceylon. *Fr.* Cannelle de Ceylan. *Sp.* Canela de Ceilan. (ó de Holanda.)	BARK—In rolls of several interrolled quills, often 3 feet long; thin bark, splitting lengthways, dense in texture, smooth on surface. *Colour*—Tawny orange-brown. *Odour and Taste*—Aromatic and delicate. *Fracture*—Splintery.	Aromatic. Essential oil. (Fig. 35.)
ARISTOLOCHIACEÆ.		
ARISTOLOCHIA SERPENTARIA. *Serpentary.* *Virginian Snake-root.* Virginia, North America. *Fr.* Serpentaire de Virginie. *Sp.* Serpentaria.	RHIZOME—Tuft of thin long fibrils, hanging from roundish root-stock, about three inches long. *Colour*—Yellowish, becoming dark brown. *Odour and Taste*—Between camphor and valerian.	Tonic febrifuge. (Fig. 208.)
EUPHORBIACEÆ.		
CROTON TIGLIUM. *Croton.* East Indies. *Fr.* Croton Tiglium.	OIL—Expressed from seeds; rather viscid. *Colour*—Yellowish red. *Taste*—Acrid. *Odour*—Slightly nauseous.	Violent purge. Local irritant. (Fig. 132.)
CROTON ELEUTERIA. *Cascarilla.* West Indies. Nassau, N.P. *Fr.* Cascarille. *Sp.* Chacarila.	BARK—In quills, short, thin, or in broken pieces, 2 to 3 inches long. *Colour*—EXT. light brown-grey, with lichens; similar to "pale" bark (cinchona). INT. darker than exterior. *Fracture*—Close, resinous. *Odour*—Somewhat fragrant, increased with heat. *Taste*—Warm and bitter.	Fragrant; aromatic tonic. Tannin. Volatile oil. (Fig. 74.)
ROTTLERA TINCTORIA. *Kamala.* India.	POWDER—Minute glands, from fruit; fine, mobile. *Colour*—Reddish brown.	(Fig. 248.)

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principl*
RICINUS COMMUNIS. *Castor Oil.* East Indies. America. South Europe, &c. *Fr.* Ricin; huile de ricin. *Sp.* Ricino; aceite de ricino.	OIL—Expressed from seeds; cold drawn thick and viscid. The *best* is colourless, tasteless, and without smell; the *ordinary* has pale straw-colour, nauseous smell, and acrid taste.	Laxative purge.
PIPERACEÆ.		
PIPER NIGRUM. *Black Pepper.* Java, &c. *Fr.* Poivre noir. *Sp.* Pimienta negra.	UNRIPE FRUIT (termed berries)—Small, round, rough exteriorly, shrivelled. On removing the "coat," white pepper produced. *Colour*—Black. *Odour and Taste*—Aromatic.	Spice. Resin; piperine. (Fig. 72.)
CUBEBA OFFICINALIS. *Cubebs.* Java, &c. *Fr.* Cubèbe. Poivre à queue. *Sp.* Cubeba.	UNRIPE FRUIT—Small, round, with network of reticulations; on stalk more than its own length. *Colour*—Black. *Odour*—Characteristic. *Taste*—Camphoraceous.	In diseases of the urethra. Cubebine. (Fig. 86.)
ARTANTHE ELONGATA. *Matico.* Peru. *Fr.* Matico. *Sp.* Matico.	LEAF—Thickish, entire, reticulated on under surface. *Colour*—Dull yellowish green. *Odour*—When fresh, aromatic.	As a mechanical styptic. (Fig. 68.)
CANNABINACEÆ.		
CANNABIS SATIVA. *Indian Hemp* (*Guaza*). India. *Fr.* Chanvre de l'Inde (Hachisch). *Sp.* Cañamo.	DRIED FLOWERING TOPS OF THE FEMALE PLANTS, *Cannabis sativa*, with flowers and fruit, if possible. *Colour*—Dull green. *Odour*—Peculiar.	Narcotic; neurotic. Resin.
HUMULUS LUPULUS. *Hop.* Indigenous. *Fr.* Houblon. *Sp.* Lupulo.	DRIED FRUIT (strobile) of female plant. Composed of scales, dry and coriaceous, with at base minute yellow grains of *lupuline*.	Stomachic tonic. Bitter extractive. Lupulin. (Fig. 223.)

	Colour—Yellowish green. *Odour*—Pleasant; aromatic. *Taste*—bitter.		
MORACEÆ. FICUS CARICA. *Fig.* Europe. *Fr.* Figue.	DRIED FRUIT—Brown; sweet; dried by exposure to sun and air.	Demulcent laxative.	
MORUS NIGRA. *Mulberry.* Europe. *Fr.* Murier noir.	FRUIT—An aggregation of small drupes. *Colour*—Dark purple-black. *Taste*—Acid; sweet.		
ULMACEÆ. ULMUS CAMPESTRIS. *Elm.* Indigenous. *Fr.* Orme champêtre. *Sp.* Olmo.	BARK—Broad thin pieces; tough and fibrous. *Colour*—Brownish yellow. *Taste*—Bitter and astringent.	Mucilaginous astringent.	(Fig. 221.)
CUPULIFERÆ. QUERCUS PEDUNCULATA. *Oak.* Indigenous. *Fr.* Chêne. *Sp.* Roble.	BARK—Dried; fibrous and brittle. (Bark of small branches and young stems.) *Colour*—EXT. brownish grey. INT. cinnamon-brown. *Taste*—Astringent.	Astringent. Tannic acid.	(Fig. 220.)
QUERCUS INFECTORIA. *Oak, bearing Galls:* (Diplolepis Gallæ tinctoriæ.) Europe. Asia. *Fr.* Noix de Galle d'Alep. *Sp.* Agalla.	GALLS—Excrescences caused by punctures and deposited ova; hard, heavy, round bodies; smooth, with short fracture. *Colour*—Bluish green or grey. *Taste*—Very astringent.	Astringent. Tannic acid. Gallic acid.	(Fig. 28.)
LIQUIDAMBARACEÆ. LIQUIDAMBAR ORIENTALE. *Styrax.* Levant. *Fr.* Styrax liquide. *Sp.* Estoraque (líquido).	BALSAM—1st, In a rough state, as liquid storax; grey, opaque, viscid. (Also as S. calamita, a brown pulverulent mass.) 2nd, Prepared by straining. Pellucid, semi-fluid. *Colour*—Brownish yellow. *Odour*—Fragrant, resembling Bals. Peru.	Local stimulant. Cinnamic acid.	(Fig. 242.)

SECT. I.—**Materia Medica**—*continued.*

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
PINACEÆ (CONIFERÆ).		
JUNIPERUS SABINA. *Savin.* *Fr.* Sabine. *Sp.* Sabina.	For description, see Part IV.	Irritant. Essential oil. (Fig. 197.
JUNIPERUS COMMUNIS. *Juniper.* Indigenous. *Fr.* Génièvre; Bais de génièvre. *Sp.* Enebro.	BERRIES (properly a galbulus)—Small, round, smooth. *Colour*—Blue-black, with a bloom. *Odour*—Pleasant. *Taste*—Sweetish.	Diuretic; as a flavour. Volatile oil.
	ESSENTIAL OIL—White; aromatic.	(Fig. 227.)
	[RESIN—Sandrach, or "Gum Juniper." From *Callitris quadrivalvis* (Mogadore), a large hard-wooded tree. Yellow drops; brittle; resembling mastiche.]	(Fig. 62.)
ABIES EXCELSA. *Spruce Fir.* Switzerland (?).	Producing Burgundy Pitch.	
ABIES BALSAMEA. Canada.	Producing Canada Balsam; pale yellow, ductile, semi-fluid oleo-resin, with peculiar odour.	(Fig. 243.)
PINUS TÆDA ET PALUSTRIS. North America.	Producing Frankincense, or "Thus."	(Fig. 236.)
LILIACEÆ.		
URGINEA SCILLA. (SCILLA MARITIMA.) *Squill.* Levant. *Fr.* Scille. *Sp.* Escila.	BULB—Sliced and dried; originally of large size, with fleshy inner scales; thick and juicy. *Colour*—Yellowish white. *Taste*—Acrid; bitter.	Expectorant; emetic. Acrid juice. (Fig. 3.)

(α) ALOE SOCOTRINA. *Socotrine Aloes.* Isle Socotra and neighbouring districts. *Fr.* Aloès sucotrindrai. *Sp.* Acibar sucotrino vero.	INSPISSATED JUICE OF LEAF—(α) Imported in casks and boxes, often mixed with "Hepatic." In irregular-sized pieces; dried. Translucent, if in flakes. *Fracture*—Shining; resinous. *Colour*—Brilliant garnet-red. *Odour*—Aromatic. *Taste*—Bitter, but slightly aromatic.	Purge.	Aloine. Resin.	α (Fig. 31.)
(β) [*Hepatic Aloes.*]	(β) [As Socotrine, but opaque, not translucent. *Colour*—Dull liver; yellowish brown.]			β (Fig. 32.)
(γ) ALOE BARBADENSIS. *Barbadoes Aloes.* Barbadoes and West Indies. *Fr.* Aloès barbade. *Sp.* Acibar de las Barbadas.	(γ) In gourds. Dull opaque mass. *Fracture*—Conchoidal, or showing numerous shell-like marks. *Colour*—Rich reddish brown or yellowish brown.			γ (Fig. 30.)
[(δ) ALOE LUCIDA. *Cape Aloes* (not officinal). Cape of Good Hope.] *Fr.* Aloès du Cap; *vulgò*, Aloès sucotrin. *Sp.* Acibar del Cabo. (A. suc)	(δ) [Bright bottle-green mass, red by transmitted light, softish in hot weather. *Fracture*—Glass-like. *Odour and Taste*—Very nauseous. *Powder*—Yellow.]			δ (Fig. 33.)
MELANTHACEÆ.				
COLCHICUM AUTUMNALE. *Colchicum.* Indigenous. *Fr.* Colchique. *Sp.* Colquico.	CORM—If fresh, size of chesnut; fleshy, with two coats; generally dried in slices; flat, solid, and pulverulent. *Colour*—EXT. reddish brown. INT. opaque white. *Taste*—Bitter.	Narcotico-acrid.	Colchicine.	(Fig. 199.)
	SEEDS—Small, brown, hard; *not* oily, but acrid.			(Fig. 121.)
VERATRUM VIRIDE. *Green Hellebore.* North America. *Sp.* Eleboro verde.	RHIZOME AND ROOTS.—Cylindrical, with numerous fibrils.		Veratria.	(Fig. 57.)

SECT. I.—**Materia Medica**—*continued.*

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
ASAGRÆA OFFICINALIS. *Sabadilla.* Mexico. *Sp.* Cebadilla.	DRIED FRUIT—Light yellowish brown follicles. Seeds, black.	Used for preparation of veratria. (Fig. 226.)
SMILACEÆ.		
SMILAX OFFICINALIS. *Sarsaparilla.* (α) Central America, *viâ* Jamaica. (β) Honduras, Vera Cruz, &c. *Fr.* (α) Salsepareille du Mexique. (β) S. de Honduras. *Sp.* Zarzaparilla.	ROOTS—(α) In bundles many feet in length, with numerous rootlets ("bearded"). In two portions: (1) Cortex, starchy; (2) Centre, woody, with pith. *Colour*—EXT. reddish brown. INT. whitish. *Taste*—Mucilaginous. (β) Inferior in quality; more starch in cortex; fewer rootlets. *Colour*—Brown, *not* reddish brown.	Alterative. (Fig. 55.)
ZINGIBERACEÆ.		
ELETTARIA CARDAMOMUM. *Cardamom.* Malabar. *Fr.* Cardamome (du Malabar). *Sp.* Cardamomo menor.	SEEDS, in pericarp. Fruit, coriaceous; short, ovate, ribbed, triangular. Seeds, angular, rough; light brown. *Colour*—EXT. brown. INT. white. *Odour and Taste*—Aromatic, almost camphoraceous.	Stomachic. Volatile oil. (Fig. 70.)
ZINGIBER OFFICINALE. *Ginger.* India. W. Indies. Africa. Cochin China, &c. *Fr.* Gingembre. *Sp.* Jengibre.	RHIZOME, with bark removed. Irregular; thick, branching in lobes of various sizes. *Fracture*—Soft, not stringy. *Colour*—Creamy white. *Odour*—Aromatic. *Taste*—Hot, pungent. (Often bleached with lime.)	Aromatic sialagogue. Gingerine. (Fig. 207.)
IRIDACEÆ.		
CROCUS SATIVUS. *Saffron.* Spain. *Fr.* Safran. *Sp.* Azafran.	STYLE AND STIGMATA—Long threads, tripartite at apex. *Colour*—Brilliant orange, staining yellow. *Odour*—Strong; peculiar. *Taste*—Little.	Colouring properties. (Fig. 250.) (Fig. 200.)

HORDEUM DISTICHON. *Barley.* Indigenous. *Fr.* Orge. *Sp.* Cebada.	with mark of line down the side. *Colour*—Whitish.			
TRITICUM VULGARE. *Wheat.* *Fr.* Blé.	FLOUR—Powdered grain of seed.	Nutritive.	Starch. Gluten.	
SACCHARUM OFFICINARUM. *Sugar-cane.* *Fr.* Canne à sucre; Sucre de canne. *Sp.* Caña.	SUGAR; from juice of the stem.			
FILICES.				
ASPIDIUM FILIX-MAS. *Male Fern.* *Fr.* Fougère male.	RHIZOME—Tufted, scaly. *Colour*—Brownish, with reddish brown scales.	Anthelmintic.	Fixed oil.	(Fig. 15.)
ALGÆ.				
[CHONDUS CRISPUS. *Carrageen, or Irish Moss.* Ireland.] *Fr.* Carragaheen ou Mousse perlée. *Sp.* Caragaheen.	[Not officinal. White to yellowish brown and grey. Crisp mass, swelling in water.]	Nutritive.	Pectin, vegetable jelly.	(Fig. 22.)
LICHENES.				
CETRARIA ISLANDICA. *Iceland Moss.* North Europe. *Fr.* Lichen d'Islande. *Sp.* Liquen Islándico.	Flat foliaceous mass; crisp, tough, coriaceous. *Colour*—Above, brownish grey; below, paler. *Taste*—Bitter and mucilaginous.	Tonic.	Starch; bitter principle.	(Fig. 21.)
FUNGACEÆ.				
CLAVICEPS PURPUREA. *Ergot.* Europe. *Fr.* Ergot de seigle. *Sp.* Cornezuelo de centeno.	Long, curved, solid, furrowed, acicular pieces. *Colour*—EXT. violet-brown. INT. pinkish. *Fracture*—Short. *Odour*—Not strong, but disagreeable.	Emenagogue.	Ergotine.	(Fig. 80.)

PART II.—**Articles of Materia Medica, non-officinal.**

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
RANUNCULACEÆ.		
HELLEBORUS NIGER. *Hellebore.* Central Europe. *Fr.* Ellébore noir. *Sp.* Eleboro negro.	RHIZOME AND ROOTLETS—Scaly, tuberculated, with long root-fibres. *Colour*—EXT. blackish brown. INT. whitish. *Odour*—Faint. *Leaves*—Pedate.	*In small doses*, local irritant. *In large doses*, drastic purge. *In excessive doses*, narcotico-acrid poison. Helleborine; acrid oil. (Figs. 50 & 187.)
DELPHINIUM STAPHISAGRIA. *Stavesacre.* South Europe. *Fr.* Staphisaigre. *Sp.* Estafisagria.	SEEDS—Numerous, compressed, assuming a triangular form; one side concave or flat, the other side convex, slightly corrugated. *Kernel*—Oily. *Odour*—Slight. *Taste*—Bitter, acrid, nauseous.	Local irritant; narcotic. Delphinium. Volatile acrid oil. (Fig. 261.)
CIMICIFUGA RACEMOSA. *Black Snake-root.* United States.	ROOT—Rough, tuberculated, with numerous rootlets. The transverse section shows a stellate marking. *Colour*—EXT. black. INT. white.	Antispasmodic; narcotic.
MAGNOLIACEÆ.		
DRIMYS WINTERI. *Winter's Bark-tree.* South America. *Fr.* Ecorce de Winter. *Sp.* Corteza Winterana.	BARK—Long rolled pieces, one or two inches in diameter. *Colour*—EXT. dull yellowish grey. INT. reddish brown. *Odour*—Aromatic. *Taste*—Warm, pungent.	Stimulant tonic. Volatile oil.
MENISPERMACEÆ.		
COCCULUS INDICUS. (ANAMIRTA COCCULUS.) *Levant Nut.* Malabar. *Fr.* Coque du Levant. *Sp.* Coca de Levante.	FRUIT—Reniform, about size of bayberry; kernel half filling the fruit. EXT. thin, blackish layer, covering white layer. INT. semilunar; hard, oleaginous; yellowish nucleus. *Taste*—Intensely bitter.	Narcotico-acrid poison. Picrotoxin. (Used in the adulteration of beer). (Fig. 262.)

VIOLA ODORATA. *Violet.* Indigenous. *Fr.* Violette odorante. *Sp.* Violeta.	PETALS. *Colour*—Purple. *Odour*—Fragrant.	Giving colour; gentle laxative. Three colouring principles. (Root, stem, and seeds contain violine=emetine.)
MALVACEÆ. ALTHÆA OFFICINALIS. *Marsh Mallow.* Indigenous. *Fr.* Guimauve. *Sp.* Altea.	LEAVES AND ROOT—The latter (generally imported "decorticated") thick, plump, mucilaginous, fibrous. *Colour*—White. (If not decorticated, exterior reddish white.) *Taste*—Sweetish.	Emollient, demulcent. Althein (=asparagin). (Fig. 46.)
CISTACEÆ. CISTUS CRETICUS. Levant. *Fr.* Ladanum ou Labdanum. *Sp.* Ládano purificado.	LABDANUM—A fragrant, gummy exudation.	Resin. Volatile oil.
TERNSTRÖMIACEÆ. THEA VIRIDIS *and* T. BOHEA. *Tea.* China. *Fr.* Thé. *Sp.* Te.	LEAVES—Used in infusion.	Stimulates and then soothes the nerves, and prevents waste of tissue. Volatile oil; tannic acid. Theine (alkaloid=caffeine). Gluten (*in leaves after infusion*).
DIPTERACEÆ. DRYOBALANOPS AROMATICA. Sumatra. Borneo.	LIQUID CAMPHOR, or Camphor Oil—Colourless, with odour of camphor. Sumatra camphor, in hard transparent crystals, much like ordinary camphor.	
AURANTIACEÆ. CITRUS BERGAMIA. *Bergamot Citrus.* *Fr.* Bergamote. *Sp.* Bergamota.	VOLATILE OIL—Green, sweet-smelling, much resembling oil of lemons.	Used in perfumery.
SIMARUBACEÆ. SIMARUBA AMARA. *Mountain Damson.* Jamaica. *Fr.* Simarouba. *Sp.* Simaruba.	ROOT-BARK—In long strips, folded; very fibrous; warty on surface. *Colour*—Yellowish brown, lighter externally. *Taste*—Bitter.	Tonic. Bitter extractive. (Fig. 78.)

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
ANACARDIACEÆ.		
PISTACIA TEREBINTHUS. *Chian Turpentine.* Levant. *Fr.* Térébenthine du Térébinthe; T. de Chio. *Sp.* Trementina de Chio.	OLEO-RESIN—Viscid when fresh, but hardening in air. *Colour*—Yellow, darkening by exposure. *Odour*—Aromatic when fresh, resembling fennel. *Taste*—Warm.	As other of the "Coniferæ" turpentines.
AMYRIDACEÆ		
BOSWELLIA THURIFERA. *Olibanon.* Arabia (*viâ* Persian Gulf and Bombay). *Fr.* Oliban; Encens. *Sp.* Incienso.	GUM-RESIN—In opaque tears, never of large size. *Fracture*—Vitreous. *Colour*—Yellowish white. *Odour*—Fragrant.	As incense. Volatile oil; resin. (Fig. 64.)

[Elemi, oleo-resin, is produced not only by the officinal plants—*Canarium commune, C. balsamiferum,* and *C. album*—but also by *Icica icicariba* (Brazil) and *Elaphrium elemiferum* (Mexico).]

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
BALSAMUM GILEADENSE. *Balm of Gilead.* Arabia. *Fr.* Baume de la Mecque. *Sp.* Balsamo de Mecca.	OLEO-RESIN—Solidifies into a yellow fragrant resin.	
LEGUMINOSÆ.		

Kino is not only the product of *Pterocarpus marsupium* (Malabar), but also of *P. erinaceus* (Senegambia), *Eucalyptus resinifera,* Botany Bay Gum (Australia), *Coccolabra uvifera* (Jamaica), and *Butea frondosa* (Bengal).]

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
ACACIA CATECHU. India. *Fr.* Cachou. *Sp.* Catecú.	CATECHU, OR KUTCH—Black extracts, in large masses, very hard, either with shining or friable fracture.	Very astringent. Tannic acid. (Fig. 4.)
MUCUNA PRURIENS. *Cowhage.*	SETÆ (hairs) no pod—Brown, thick on pod; very irritating to cuticle.	Anthelmintic (mechanical).

COUMAROUNA ODORATA. *Tonquin Bean.* Asia. *Fr.* Fève Tonka. *Sp.* Habas de Tonkin.		principle, existing in the *Melilot.* (Fig. 265.)
ROSACEÆ.		
POTENTILLA TORMENTILLA. Indigenous. *Fr.* Tormentille. *Sp.* Tormentila.	RHIZOME AND ROOTLETS—Large, irregular, knotty. *Colour*—EXT. Red-brown. INT. Flesh-red. *Fracture*—Resinous.	Astringent tonic. Tannin. (Fig. 256.)
CYDONIA VULGARIS. *Quince.* South Europe. *Fr.* Cognassier; Coing. *Sp.* Membrillo (Cydonium).	SEEDS—Angular, with one side convex and two flat. Numerous in yellow pome. (The external coat contains much mucilage in thin cells.) *Colour*—Brown.	Demulcent. Cydonin. Gum (insoluble).

UMBELLIFERÆ.

The plants in this order may be classed under four heads:—

1. Yielding carminative fruit, with volatile oil.
2. With edible roots.
3. Possessing poisonous (narcotico-acrid) properties, as *conium*.
4. Yielding a fœtid oleo-gum-resin.

The plants *not* in the Pharmacopœia, but which are important, are as follows:—

1. *Cuminum Cyminum*	Cumin. *Fr.* Cumin. *Sp.* Comino.
2. *Daucus Carota*	Carrot. ,, Carotte.
Archangelica officinalis	Angelica. ,, Angélique officinale.
4. *Sagapenum* (*Ferula?*)	Sagapenum, gum-resin, having physical characters between assafœtida and galbanum. *Fr.* Sagapénum.
Opoponax Chironum	Opoponax, rarely seen, and scarcely ever employed. Resembles galbanum. *Fr.* Opoponax. *Sp* Opoponaco.

(For further information on the subject of the Oleo-gum-resins of the Umbelliferæ, see a paper by the Author in *Pharm. Journal*, June, 1868.)

SECT. I.—**Materia Medica**—*continued.*

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
RUBIACEÆ.		
COFFEA ARABICA. *Coffee.* Arabia, &c. *Fr.* Café.	DRIED FRUIT, OR BERRIES.	Antisoporific. Stimulant. Caffeine.
PSYCHOTRIA EMETICA. *Striated Ipecacuanha.*	Substitutions of true Ipecacuanha.	
RICHARDSONIA SCABRA. *Undulated Ipecacuanha.*		
RUBIA TINCTORUM. *Madder.* Levant. South Europe. *Fr.* Garance.	ROOT, ground up. In reddish yellow coarse powder.	Used for dyeing. (Fig. 255.)
COMPOSITÆ.		
INULA HELENIUM. *Elecampane.* Indigenous. *Fr.* Aunée. *Sp.* Enula.	DRIED ROOT—Slices, thin, often contorted; friable. *Colour*—Grey-yellow. *Odour*—Camphoraceous. *Taste*—Warm.	Aromatic tonic (*little used*). Inulin (amylaceous). Helenin (crystalline). (Fig. 257.)
ARTEMISIA ABSINTHIUM. *Wormwood.* Indigenous. *Fr.* Absinthe grande. *Sp.* Ajenjo.	DRIED HERB—In bundles, soft and silky. *Colour*—Silver-greyish green. *Odour*—Aromatic. *Taste*—Bitter. [A species of Artemisia gives the glucoside Santonin.]	Tonic. Absinthin. Volatile oil. (Fig. 252.)
ARTEMISIA SANTONICA. *Specie varice.* Russia. *Fr.* Semen contra.	Broken peduncles, mixed with the calyx and flower buds.	Vermifuge. (Fig. 228.)
CICHORIUM INTYBUS. *Chicory.* *Fr.* Chicorée. *Sp.* Achicoria.	ROOT—Long tap-root, whitish, fleshy. FLOWERS—Bright blue.	Used to adulterate coffee, roasted and ground up.

Safflower. *Fr.* Carthame. *Sp.* Cartamo de Españo.		
PYROLACEÆ.		
CHIMAPHILA (PYROLA) UMBELLATA. *Winter-green.* United States. *Fr.* Pyrole ombellée.	HERB—Consisting of stem and leaves. Evergreen, coriaceous, smooth, shining; leaves smallish and serrate.	In nephritic disease, tonic astringent. Volatile oil; bitter extractive; tannin.
ERICACEÆ.		
GAULTHERIA PROCUMBENS. *Partridge-berry.* *Winter-green.* United States. *Fr.* Gaulthérée couchée.	Produces a fragrant volatile oil, sold as Oil of Winter-green.	Perfume.
LOGANIACEÆ.		
SPIGELIA MARILANDICA. *Caroline Pink.* United States. *Fr.* Spigélie.	DRIED HERB, WITH ROOTS—The former is long, with lanceolate leaves; the latter consists of numerous thin, brown fibres. *Colour*—Grey-green. *Taste*—Bitter.	Anthelmintic, as a narcotico-irritant. Bitter extractive. (Fig. 253)
IGNATIA AMARA. *St. Ignatius's Bean.* *Fr.* Fève de St. Ignace. *Sp.* Haba de San Ignacio.	Dark brown, slightly angular seeds, about size of olive.	Strychnia.
ORAGINACEÆ.		
ALKANA TINCTORIA. *Alkanet.* *Fr.* Organette. Ancusa de tinte.	ROOT—Dark reddish brown, irregular, tough; blood-red internally.	Dye. (Fig. 254.)

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
SOLANACEÆ.		
SOLANUM TUBEROSUM. *Potato.* *Fr.* Pomme de terre.	TUBER—As food.	**Nutritive.** **Starch.**
SCROPHULARIACEÆ.		
VERBASCUM THAPSUS. *Great Mullein.* Indigenous. *Fr.* Bouillon blanc. *Sp.* Verbasco.	LEAVES.	**Demulcent.** (Fig. 190.)
LABIATÆ.		

This natural order contains a number of plants the essential character of which is, from the presence of an essential oil, aromatic, warm, or carminative.

POGOSTEMON PATCHOULI	Patchouli	Malay, Penang.
MENTHA PULEGIUM	Pennyroyal. *Fr.* Pouliot commun . .	Indigenous.
ORIGANUM VULGARE	Marjoram. „ Origan	
„ MARJORANA	„ „ Marjolaine vulgaire . *Sp.* Mejorana . . .	Asia.
THYMUS VULGARIS	Thyme. *Fr.* Thym	South Europe.
MELISSA OFFICINALIS	Balm. „ Mélisse . . . . . *Sp.* Melisa	
MARRUBIUM VULGARE	Horehound. *Fr.* Marrube blanc . .	Indigenous.

POLYGONACEÆ.		
RUMEX ACETOSA. *Common Sorrel.* Indigenous. *Fr.* Oseille commune.	LEAVES.	**Potassium superoxalate.**

POLYGONUM BISTORTA. *Great Bistort.* Indigenous. *Fr.* Bistorte. *Sp.* Bistorta	ROOT—Twice bent on itself, rugous. *Colour*—EXT. brown. INT. reddish.	Astringent.	Tannic acid.	
LAURACEÆ.				
LAURUS NOBILIS. *Sweet Bay.* *Fr.* Laurier commun. (Baies de laurier.)	FRUIT—Called "Bay-berries." Round; the kernel in a dark brown brittle coat.			(Fig. 263.)
CINNAMONUM CASSIA. *Cassia lignea.* China, Java. *Fr.* Cannelle de Chine *Sp.* Canela de Manila ó de China.	BARK—In bundles, rolled in quills; thick and coarse compared with cinnamon. *Colour*—Dark reddish brown. *Odour and Taste*—Warm and aromatic. IMMATURE FLOWERS—Cassia buds.	Aromatic.	Essential oil.	(Fig. 34.)
ARISTOLOCHIACEÆ.				
ASARUM EUROPÆUM. *Asarabacca.* Indigenous. *Fr.* Asarum; Cabaret.	LEAVES—ROOT.	Emetic; errhine.	Acrid volatile oil.	
ARISTOLOCHIA LONGA. (A. ROTUNDA.) *Birthwort.* Indigenous. *Fr.* Aristoloche longue. *Sp.* Aristoloquia larga ó redonda.	ROOT—Long and round; fleshy, amylaceous. *Colour*—EXT. brown. INT. whitish. *Taste*—Bitter and acrid.		Bitter extractive.	(Fig. 47.)
EUPHORBIACEÆ.				
MANIHOT UTILISSIMA. (JATROPHA MANIHOT.) *Cassava.* Brazils, &c. *Fr.* Manihot ou manioc.	FECULA OF ROOT—Tapioca: the starch deposited from expressed juice of root. In white granulated masses.	Nutritive.	Starch.	

Sect. I.—**Materia Medica**—*continued.*

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
EUPHORBIA CANARIENSIS. *Euphorbia.* Canary Islands. *Fr.* Euphorbe des Canaries. *Sp.* Euphorbio.	RESINOUS JUICE—Saline waxy resin, wrongly called gum. Irregular tears, slightly friable, pierced with one or two holes. *Colour*—Dirty yellowish white. *Taste*—Acrid, burning. The powder acts as a most powerful errhine.	Powerful local irritant. Acrid resin. (Fig. 264.)
PIPERACEÆ. CHAVICA ROXBURGHII. *Long Pepper.* India. *Sp.* Pimienta targa.	DRIED SPIKES OF AGGLOMERATED BERRIES—Pungent.	Stimulant. (Fig. 71.)
MORACEÆ. DORSTENIA CONTRAYERVA. *Contrayerva.* Brazils. *Sp.* Contrayerba.	ROOT-STOCK, with fibres—Yellowish brown fleshy root, with aromatic smell and taste.	Stimulant tonic.
ULMACEÆ. ULMUS FULVA. *Slippery Elm.* United States.	INNER BARK—In long fibrous pieces.	Demulcent.
CUPULIFERÆ. QUERCUS SUBER. *Cork-tree.* South Europe.	CORK—Exterior bark, or suberous layer; elastic cellular mass.	Traces of tannic acid.
SALICACEÆ. SALIX (ALBA ?). *Willow.* Indigenous. *Fr.* Saule blanc. *Sp.* Sauce.	BARK—Quilled; light brown. *Taste*—Bitter and astringent.	Astringent tonic; febrifuge. Salicine (glucoside); tannic acid.

PINACEÆ.

PINUS SYLVESTRIS. North Europe.	Tar, turpentine, pitch, deal-wood.	*Sp.* Trementina de pino.
P. PINASTER. South-West France.	Bordeaux turpentine.	
P. PALUSTRIS *and* P. TÆDA. North America.	Frankincense or Thus.	
ABIES EXCELSA. North and Central Europe.	Burgundy pitch.	
A. BALSAMEA. Canada.	Canada balsam.	*Sp.* Trementina de Canada.
A. PICEA. Central Europe.	Strasburg turpentine.	,, ,, de Abeto.
A. NIGRA. North Europe.	Essence of spruce; spruce beer.	
LARIX EUROPÆA. *Larch.* Mountains of Central Europe.	Venice turpentine.	*Sp.* Trementina de Venecia.

The above products may be divided as follows:—

1. Oleo-resinous juices . .	As turpentine in a state of nature; Canada turpentine.	
2. Volatile oil	As oil of turpentine (distilled).	
3. Resin	Product left after distillation. *Fr.* Colophone.	*Sp.* Resina de pino.
4. Tar, pitch . . .	Produced by destructive distillation.	

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
AROIDACEÆ. ARUM MACULATUM. Indigenous.	TUBER, which, dried and powdered, gives "Portland arrow-root."	Starch.
ACORUS CALAMUS. *Sweet Flag.* Indigenous. *Sp.* Acoro.	RHIZOME—Thick, fleshy (soon drying up), with numerous rootlets. *Colour*—Light brown. *Odour*—Aromatic.	Aromatic stimulant. Volatile oil. (Fig. 258.)
PALMACEÆ. SAGUS LÆVIS. East Indies. *Fr.* Sagou. *Sp.* Lagú.	SAGO—Granulated pith of the palm.	Nutritive.
ELAIS GUINEENSIS. West Coast of Africa. *Fr.* Huile de palme. *Sp.* Aceite de palma.	PALM OIL—Deep orange; solid oil obtained, by boiling in water, from the fleshy coat (sarcocarp) of the fruit (drupe).	
COCOS NUCIFERA. Ceylon. *Sp.* Aceite de coco.	THE COCOA-NUT—Cocoa-nut oil; a white solid fat, from the fruit.	
CALAMUS DRACO. *Dragon's-blood Tree.* East Indies. Socotra. *Fr.* Sang-Dragon. *Sp.* Sangre de dragon.	RESIN, termed "Dragon's blood." [Similar products are also, like gum kino, obtained from other trees—*ex. gr.*, Pterocarpus Draco (Leguminosæ), Dracæna Draco (?) (Liliaceæ.)] In rough, irregular pieces, of hard though pulverulent consistence. *Colour*—Red, mottled, dark and bright. *Powder*—Bright red. No odour. Little taste.	Principally in varnishes. (Fig. 65.)
ARECA CATECHU. *Betel-nut.* South Asia. *Fr.* Noix d'arec. *Sp.* Nuez de arica indica.	SEEDS—Size of nutmeg; conical, with flattened base; horny. *Colour*—EXT. reddish brown. INT. brown, with whitish veins. Inodorous.	(Fig. 23.)

	CATECHU, in cakes or bulbs—An astringent extract, dark in colour and hard in consistence, is obtained from this plant.	Tannic acid.
LILIACEÆ. ALLIUM SATIVUM. *Garlic.* *Fr.* Ail. ALLIUM CEPA. *Onion:* Cultivated in England. *Fr.* Oignon.	BULBS.	Stimulant stomachic.
XANTHORRHŒA HASTILIS. *Grass-tree.* Australia.	BLACK-BOY GUM—A red balsamic resin, resembling dragon's blood.	In chronic catarrhs. Resin; benzoic acid; cinnamic acid; volatile oil.
MELANTHACEÆ. VERATRUM ALBUM. *White Hellebore.* Central Europe. *Fr.* Ellébore blanc. *Sp.* Eleboro blanco.	RHIZOME, with many thickish rootlets—Fleshy, irregular, contracted, generally divided, cylindrical, scaly. *Colour*—EXT. brownish white. INT. whitish. Little odour. *Taste*—Bitter, acrid.	*In small doses*, promotes secretion. *In large doses*, acrid irritant. Volatile oil. (Fig. 58.)
IRIDACEÆ. IRIS FLORENTINA. *Oris.* South Europe. *Fr.* Iris de Florence.	RHIZOME—Decorticated cylindrical pieces. White, fragrant. Pulverized, as "violet powder."	Perfume (irritant ?). Volatile; acrid. (Fig. 259.)
MARANTACEÆ. MARANTA ARUNDINACEA. *Arrow-root.* West Indies. Natal, &c. *Fr.* Arrowroot de la Jamaïque.	FECULA (starch)—From tubers. White, opaque, pulverulent mass.	Demulcent, nutritious. Starch.

Natural Order, Name, and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
CANNA EDULIS. *Tous-les-Mois.* St. Kitts.	Peculiar form of starch, prepared as "arrow-root;" resembles potato-starch, but more *satiny*.	Starch.
ZINGIBERACEÆ.		
CURCUMA LONGA. C. ROTUNDA. *Turmeric.* India. China. *Fr.* Curcuma long; C. rond. *Sp.* Curcuma.	TUBERS—Round or long, cylindrical or spherical; irregular, small, wrinkled, with transverse divisions. *Colour*—EXT. Dirty yellow. INT. Marbled, orange-yellow. *Fracture*—Resinous. *Odour*—Aromatic.	Dye; stomachic. Curcumin (colour); Volatile oil. (Fig. 49.)
CURCUMA ZEDOARIA. *Zedoary-root.* *Fr.* Zédoaire. *Sp.* Zèdoaria.	Resembles above, but now little used.	
AMOMUM MELEGUETA. *Grains of Paradise.* Guinea Coast. Demerara. *Fr.* Maniguette. *Sp.* Manigueta.	SEEDS—Guinea grains. Roundish or angular, shining, minutely corrugated. *Colour*—EXT. Golden brown. INT. White. *Odour*—Aromatic. *Taste*—Pungent.	In the adulteration of beer; in veterinary medicine. Volatile oil. (Fig. 59.)
ORCHIDACEÆ.		
ORCHIS MASCULA, &c. *Salep.* Levant. *Fr.* Salep. *Sp.* Salep.	DRIED TUBERCULES—Small, smooth, irrelarly-palmate pieces, strung together. *Colour*—Dirty white.	Starch.
VANILLA SATIVA, &c. Mexico, &c. *Fr.* Vanille. *Sp.* Vainilla.	POD—Long, narrow, flattened, slightly furrowed, dried; often coated with white crystals (cinnamic acid). *Colour*—Dark brown. *Odour*—Very fragrant.	Flavour. Cinnamic acid. (Fig. 258.)

GRAMINACEÆ.			
ORYZA SATIVA (*Rice*). *Fr.* Riz. *Sp*. Arroz. ZEA MAYS (*Indian Corn, Maize*). AVENA SATIVA (*Oat*). *Fr.* Avoine. SECALE CEREALE (*Rye*). ,, Seigle.	SEEDS.	Nutritive. Starch.	
ANDROPOGON MURICATUS. India.	Cuscus, or vetivert.	Used as perfumes.	
A. CALAMUS AROMATICUS. India.	Ginger-grass oil, or oil of geranium or rose-geranium.		
A. CITRATUM. India. Ceylon.	Lemon-grass oil, or oil of verbena.		
TRITICUM REPENS. *Couch Grass.* Indigenous. *Fr.* Chiendent.	THE CREEPING STEM, cut.		(Fig. 260.)
LICHENES.			
ROCCELLA TINCTORIA. *Dyer's Weed.*	Orchella, litmus, cudbear.	Colour.	
FUNGI.			
MYCODERMA CERVISIÆ.	Yeast plant.		
AGARICUS CAMPESTRIS.	Mushroom.		
LYCOPODIACEÆ.			
LYCOPODIUM CLAVATUM. *Club-moss.* Indigenous. *Fr.* Lycopode.	FINE POWDER, consisting of the sporules; very mobile; pale yellow; odourless; tasteless.	Used to surround pills.	

PART III.—**Animal Materia Medica.**

Divisions.	*Subdivisions.*	*Class.*	*Order.*	*Examples (in Mat. Med.)*
I. INVERTEBRATA	I. Acrita	i. Poriphera		Spongia.
		ii. Polypiphera		Corallium.
	II. Radiata			["Star-fish"].
	III. Mollusca	iii. Conchifera		Ostrea.
		iv. Cephalopoda		Sepia.
	IV. Articulata	v. Annulosa		Hirudo.
		vi. Insecta	1. Coleoptera	Cantharis.
			2. Hemiptera	Coccus.
			3. Hymenoptera	Apis.
		vii. Crustacea		[Cancer].
II. VERTEBRATA		viii. Pisces		Morrhua.
		ix. Aves		Gallus.
		x. Mammalia	1. Cetacea	Physeter.
			2. Ruminantia	Moschus. Cervus. Ovis. Bos.
			3. Pachydermata	Sus.
			4. Rodentia	Castor.
			5—10. Six orders.	

Name and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*
[Spongia officinalis. *Sponge.* Mediterranean. *Fr.* Éponge fine. *Sp.* Esponja.	The dry skeleton of the removed gelatinous animal.	
Sepia officinalis. *Cuttle-fish.* Ocean. *Fr.* Sèche. *Sp.* Hueso de jibia.	The oval, cellular, calcareous structure deposited in the "mantle." The colour "sepia" is its inky secretion.]	
HIRUDO.		
(α) Sanguisuga medicinalis. *The Speckled Leech.* *Fr.* Sangsue médicinale. *Sp.* Sanguijuela. (β) S. officinalis. *The Green Leech.* South and Central Europe.	Long, tapering body, plano-convex, with transverse marks and six longitudinal stripes. *Colour*—Olive-green, belly spotted with black in (α).	
CANTHARIS.		
C. vesicatoria. South and Central Europe. *Fr.* Cantharide. *Sp.* Cantarida.	Dried elongated Insect, with two beautiful wing-cases, which are long, flexible, and of a brilliant metallic lustre, and a golden green colour. *Odour*—Disagreeable and penetrating. *Powder*—Greenish brown, with minute shining green particles.	Vesicatory. Cantharidine (crystalline). (Fig. 119.)
COCCUS.		
C. cacti. Mexico (on Opuntia [Cactus]). *Fr.* Cochenille. *Sp.* Cochinilla (blanc ó negro).	Dried insect—Small, roundish; one side convex, one flat; wrinkled; the "silver" variety with a white dust. When powdered and prepared, it yields *Carmine.* *Colour*—Purplish grey; the "dark" variety purple.	Colour. Carminic acid. (Fig. 129.)

Name and Geographical Source.	*Characteristics.*	*Properties and Active Principle.*	
C. LACCA. India. *Fr.* Laque (résine).	SHELL-LAC—A product secreted round itself by this insect, and afterwards melted into flat thin pieces.	In varnishes.	
APIS.			
A. MELLIFICA. *Bee.*	HONEY, WAX. *Fr.* Miel; Cire.		(Fig. 217.) (Fig. 218.)
ICHTHYOCOLLA, from ACCIPENSER STELLATUS. *Sturgeon.* Russia. *Fr.* Colle de poisson. *Sp.* Ictiocola; colade pescado	THE SWIMMING BLADDER of the fish, dried and cut in strips. White, odourless, and tasteless.		

[Brazilian isinglass has a deeper colour, strong odour, and is less soluble; its source is uncertain.]

MORRHUA.			
GADUS MORRHUA VULGARIS. *Cod.* Near Newfoundland and Norway. *Fr.* Morue; Huile de foie de morue. *Sp.* Aceite de hégado de bacalao.	THE OIL, extracted by heat, from the liver of the cod. Limpid. *Colour*—Pale yellow. *Odour*—Little. *Taste*—Perfectly fresh.	As a "fattening" tonic.	(Fig. 135.)
PHYSETER MACROCEPHALUS. *Cachalot.* (Yielding "cetaceum.") *Fr.* Blanc de baleine. *Sp.* Esperma de balena.	THE CONCRETE FAT, contained in cellular tissue, found in large cavities in the head. Nearly pure "cetine." White, solid, laminated substance; tasteless and almost odourless; fatty, but not greasy.	Emollient.	(Fig. 120.)

[Ambergris—found in the cachalot, supposed to be a biliary product—a solid, opaque, striated, bluish grey substance, with pleasant musk-like odour.]

MOSCHUS MOSCHIFERUS. *Musk Deer.* Thibet. *Fr.* Musc. *Sp.* Almizcle (Tonka).	INSPISSATED SECRETION of the preputial sac. Oval pods, covered on one side with hairs, containing a granular, unctuous, reddish brown substance, with very powerful odour.	Nervous excitant; antispasmodic. Ammonia.	

[Cabardine musk is in *longer* pods, and has a disagreeable *empyreumatic* odour. Used as an adulteration.]

CERVUS ELEPHAS. *Stag.* Europe. *Fr.* Corne de cerf.		
OVIS ARIES. *Sheep.*	MUTTON SUET—Fatty substance. *Fr.* Suif.	
BOS TAURUS. *Ox (and the female).*	MILK.	Lactic acid; casein; salts; fat(butter); sugar of milk.
	BILE—Purified. *Fr.* Bile de bœuf.	
SUS SCROFA. *Hog.*	LARD—White, odourless, and tasteless. *Fr.* Axonge ou Graisse de porc.	
CASTOR FIBER. *Beaver.* America. Europe. (Danube, &c.) *Fr.* Castoreum. *Sp.* Castoreo.	CASTOREUM (American)—Two sacs, containing a secretion from the preputial follicles. Wrinkled, soft; in pairs, containing unctuous matter. *Colour*—Dark brown. *Odour*—Powerful, fœtid. [Russian is very rarely met with.]	Stimulant; antispasmodic.

Sect. I.—**Materia Medica**—*continued.*

PART IV.—**Medicinal Plants.**

The more important medicinal plants that are either indigenous or are cultivated in England, and therefore likely to be met with in a fresh state, are as follows:

1. Conium.
2. Aconitum.
3. Sabina.
4. Digitalis.
5. Belladonna.
6. Hyoscyamus.
7. Stramonium.

The whole of these plants have active principles so powerful, and properties so likely, when employed in excessive doses, to produce dangerous consequences, that it is absolutely necessary that their appearance should be familiar to the student of medicine; not only ought there to be no chance of any substitution, by inadvertence, of one leaf for another, but there ought to be no difficulty in the recognition, among a handful of innocuous native plants, of the dangerously active Digitalis or the poisonous Conium.

The essential characters of these plants are—

Name.	*In a Fresh State.*	*In a Dry State.*
1. CONIUM MACULATUM. *Spotted Hemlock.*	LEAVES AND YOUNG BRANCHES. *Leaves*—Much divided, smooth, feathery in appearance. *Stem*—Smooth, with dull purple stains. Rubbed with potash solution, a mouse-like fœtid odour is developed (conia, volatile alkaloid). (*Flower*—Small, white, arranged in umbels. *Fruit*—Small, ovate, two-celled, with wavy or crenate ridges.)	Leaves separated from branches; deep green. Same characters as the fresh. (Fig. 196.) (To be distinguished from Æthusa Cynapium. Fig. 195.)
2. ACONITUM NAPELLUS. *Aconite.*	FRESH LEAVES AND FLOWERING TOPS. *Leaves*—Palmate, divided, to the petiole (or leaf-stalk), into five deeply cut, wedge-shaped lobes, each lobe having pointed segments. *Flowers*—A raceme of irregular deep blue flowers. (*Fruit*—Dry; hard; follicular.)	Leaves much shrivelled. (Fig. 188.)
3. JUNIPERUS SABINA. *Savin.*	FRESH TOPS—Evergreen branches densely covered with minute thick leaves in four rows. *Odour*—Strong. *Taste*—Acrid; bitter. (*Fruit*—Round, purple, size of currant.)	(Fig. 197.) (To be distinguished from Cupressus sempervirens. Fig. 198.)

4. DIGITALIS PURPUREA. *Foxglove.*	LEAVES—Alternate, rugose. (*Flowers*—Crimson, hanging, bell-shaped, arranged on an elongated main stalk.) (To be distinguished from Verbascum Thapsus. Fig. 190.)	Leaves, long, somewhat egg shaped, tapering at base; short leaf-stalk, merging into the leaf itself; downy; paler on under surface. Dull green; slight odour; bitter taste. (Fig. 189.)
5. ATROPA BELLADONNA. *Deadly Nightshade.*	FRESH LEAVES WITH BRANCHES. *Leaves*—Alternate, three to six inches, long; short leaf-stalks; egg-shaped, sharp-pointed, smooth, soft; margin undivided; often in pairs of unequal size (important character). (*Flower*—Solitary, bell-shaped, purple. *Fruit*—Violet-black berry, two-celled, size of cherry.)	Leaves separated from branches: dull green; little odour or taste. (Fig. 192.)
6. HYOSCYAMUS NIGER. *Henbane.*	FRESH LEAVES WITH BRANCHES. *Leaves*—From biennial. plants; oblong acute, unequally and acutely cut (sinuated), clammy and hairy; pale dull green colour; fœtid odour; slightly acrid taste. (*Flower*—Funnel-shaped, dull straw-colour, with purple veins. *Fruit*—Capsule opening transversely by convex lid; many-seeded).	Leaves removed from branches Characters of fresh leaf, but with fainter odour, and absence of clamminess. (Fig. 191).
7. DATURA STRAMONIUM. *Thorn-apple.*	LEAVES—Unequal at base, large, smooth, acutely toothed, simply veined, light dull-green colour. (*Flower*—Large, white, regular, funnel-shaped. *Fruit*—Dry, prickly capsules, four-celled below, two-celled above, size of walnut.	Leaves, large, ovate, deeply incised. (Fig. 193.)

PART V.—Groupings of the Geographical Sources of the Pharmacopœia Materia Medica.

EUROPE.

NORTHERN EUROPE	Cetraria, Terebinthina, Resina, Pix.
Russia	Santonica, Sumbul.
Great Britain (*indigenous or cultivated*)	Aconitum, Anethum, Anisum, Anthemis, Armoracia, Belladonna, Conium, Coriandrum, Digitalis, Dulcamara, Ecbalium, Filix-mas, Glycyrrhiza, Hordeum, Hyoscyamus, Juniperus, Lactuca, Lavandula, Linum, Lupulus, Mentha (*M. piperita* and *M. viridis*), Mezereum, Morus, Papaver (*P. rhœas*), Quercus, Rhamnus, Rosa (*R. canina*, wild; *R. centifolia* and *R. gallica*, cultivated), Rosmarina, Ruta, Sabina, Sambucus, Scoparius, Sinapis (*S. alba* and *S. nigra*), Stramonium, Taraxacum, Triticum, Ulmus, Uva Ursi, Valeriana.
CENTRAL EUROPE	Arnica, Ergota, Gentian; Hirudo.
Switzerland	Pix Burgundica.
Hungary, &c.	Cantharis.
SOUTH EUROPE	
Shores of Mediterranean	Aurantium, Amygdala (*A. dulcis*), Colocynthis, Crocus, Fœniculum, Granatum, Laurocerasus, Limo, Oliva, Prunus, Scilla, Uvæ.
Sicily and Calabria	Manna.

ASIA.

WESTERN ASIA.	
Scio (island)	Mastiche.
Levant	Ficus, Pyrethrum, Styrax.
Asia Minor	Acacia, Opium, Scammonium, Scammonia (radix), Tragacantha.
Arabia	Myrrha.
Socotra (island)	Aloe.
CENTRAL ASIA.	
Persia and N. E. India	Ammoniacum, Assafœtida, Galbanum.
Thibet and Tartary	Rheum; Moschus.
China	Camphora, Illicium (*I. anisatum*).
SOUTHERN ASIA.	
India	Cannabis indica, Hemidesmus, Kamala, Nux vomica, Croton, Ricinus, Sumbul, Zingiber.
North India	Chirata.
South India	Senna (*cultivated*).
Malabar Coast	Bela, Cardamomum, Kino.
Ceylon	Cinnamomum, Pterocarpus.
Siam	Cambogia, Benzoin.

East Indian Islands	Caryophyllum, Cassia (*C. fistula*), Cubeba, Myristica, Piper nigrum.
Singapore, &c.	Catechu pallidum, Cajuputi.
Manilla (Philippine Islands)	Elemi.
Sumatra	Benzoin.

AFRICA.

North Africa.	
Egypt, &c.	Senna.
Mogadore	Amygdala (*A. amara*).
West Coast	Calumba, Physostigma.
East Africa.	
Abyssinia.	Cusso.
Zanzibar	Capsicum.
South Africa.	
Cape of Good Hope	Buchu.

AMERICA.

North America.	
Hudson's Bay Territory	Castoreum.
Canada	Terebinthina canadensis, Podophyllum.
United States	Veratrum viride, Lobelia, Senega, Sassafras.
Southern States	Gossypium, Serpentaria, Tabacum, Thus.
Central America	Sarsa (*imported from Jamaica*).
Salvador	Balsamum peruvianum.
Mexico	Jalapa, Sabadilla; Coccus.
Honduras and Jamaica	Hæmatoxylum.
South America.	
New Granada	Balsamum tolutanum.
Guiana	Nectandra.
Peru	Krameria, Matico.
North-Eastern Districts	Cinchona (*C. flava*, *C. pallida*, and *C. rubra*).
Brazil	Copaiba, Ipecacuanha, Pareira.
Tropical Districts	Cusparia, Theobroma (*T. Cacao*).
West Indies	Guaiacum, Canella alba, Saccharum, Tamarindus, Zingiber.
Jamaica	Quassia, Pimenta.
Barbadoes	Aloe.
Bahamas	Cascarilla.

Pacific and Indian Oceans	Cetaceum.
Atlantic Ocean and North Sea (Europe)	Morrhua.

PART VI.—**Adulterations.**

The substitution of spurious or adulterated for genuine drugs is one of those abuses that, with the increase of scientific knowledge, is fortunately very materially decreasing; still, great care must continue to be exercised. To still further decrease this evil, and to facilitate a greater familiarity with the appearance that the spurious drug affords, as contrasted with the genuine, the following tabular arrangement of the principal drugs shows, the essential characters of the drug in a state of purity, side by side, with those that mark the inferior quality or the substitution of some other article.

The Adulteration of Chemicals is treated further on in the work.

Article of Materia Medica.	*Adulteration or Substitution.*	*Characters.*	
		Genuine.	*Spurious.*
OPIUM. (“*Turkey.*”) (Fig. 123.)	(α) Ext. poppies. (β) Gum, starch. (γ) Chaff, dross. (δ) Stones, shot, lead. (ε) Inferior qualities, as “Egyptian.”	Remains good. *Consistence*—Granular. *Colour*—Black, or reddish turning to black. *Odour*—Peculiar, but sweet.	Turns mouldy. (β) *Consistence*—Homogeneous; viscid. (αβ) Pieces of dross, &c. (γ) *Colour*—Reddish brown; becomes lighter in colour. (ε) *Odour*—Sour, musty. (α) *Weight*—Unusually heavy. (δ)
CANELLA ALBA. *Bark.* (Fig. 73.)	Winter’s Bark.	*Colour*—EXT. light buff. INT. lighter.	*Colour*—EXT. brown. INT. darker than exterior.
COCHLEARIA. *Horse-radish.*	Aconite. (*Root.*) (Fig. 45.)	Tapering very gradually, though suddenly for an inch at apex. *Length*—About eighteen inches to two feet. *Colour*—EXT. and INT. yellow-white. *Taste*—Simply pungent.	Tapering rapidly, almost conical; with fibrils. *Length*—About four inches. *Colour*—EXT. coffee-coloured. INT. bright yellow. *Taste*—Acrid, then producing a sensation of numbness.

ANGUSTURA BARK. (Fig. 75.)	Strychnos Nux-vomica. (*Bark.*) [*Fr.* Angusture fausse.]	Thin regular pieces, about six inches long. *Ext.*—Yellowish grey epidermis, easily to be rubbed off. *Taste*—Aromatic.	Thick, irregular, often twisted, various lengths. *Ext.*—Rusty efflorescence (if old); warty. Leprous „ (if young). *Taste*—Intensely bitter. Nitric acid stains bark green; inner bark, *red* ("*brucine*").
MYRRH. (Fig. 25.)	Gum bdellium. (Fig. 26.)	The size of the genuine and the spurious is about the same. Irregular-shaped tears or masses; soft or brittle; opaque. *Colour*—Mottled white and red. *Fracture*—Breaks with ease, and irregular. *Odour*—Aromatic.	Hard nodules; generally translucent. *Colour*—Uniform; dark red. *Fracture*—Very adhesive; tough; elastic; generally regular surface. *Odour*—Very slight.
GUM ACACIÆ. (Fig. 1.)	Senegal gum. (Fig. 2.)	Brittle pieces; small. *Colour*—Yellow-white. *Fracture*—Apparently crystalline (sometimes vitreous).	Hard, tough; large pieces; translucent. *Colour*—Often red or yellow. *Fracture*—Glassy; shining.
SENNA. (*Alexandrian.*) (Fig. 84.)	Leaves of Cynanchum argel (Fig. 186); (also Tephrosia apollinea, Colutea arborescens, and Coriaria myrtifolia).	Thin leaf. *Base of Leaf*—Unequal; one lobe larger than the other. *Veins*—Apparent, on under surface. *Colour*—Green.	Thick, coriaceous (leather-like). *Leaf*—Base, quite equal; two lobes equal in size. *Veins*—Buried. *Colour*—Very pale silvery green. *Taste*—Bitter.
GUAIACUM. *Resin.* (Fig. 61.)	Pine resin. (*From turpentine.*)	If burned, faint pleasant odour	Disagreeable odour of turpentine.

SECT. I.—Materia Medica—*continued.*

Article of Materia Medica.	*Adulteration or Substitution.*	*Characters.*	
		Genuine.	*Spurious.*
COPAIBA. *Oleo-resin.* (Fig. 116.) (Erroneously termed "Balsam.")	(ζ) Wood oil of India. (η) Turpentine. (θ) Castor-oil, or fatty oils.	*Colour*—Bright light yellow-red. *Heat*—Remains fluid at 280°. *Odour*—Peculiar to copaiba. If heated on bibulous paper, no stain. Dissolves $\frac{1}{4}$ weight mag. carb., remaining translucent, or solidifies with $\frac{1}{16}$ weight mag. calc.	*Colour*—Dark brownish orange. (ζ) *Heat*—Becomes solid if heated to 276°. *Odour*—If heated, odour of turpentine. (η) Grease-spot remains. (θ) Opaque; thick with mag. carb.
TRAGACANTH. *Gum.* (Fig. 6.)	Foreign white gums. (Moussa and Taramania). (Considered by some to be an inferior quality of Tragacanth.)	In flakes; broad and thin. *Colour*—White.	In irregular pieces; small. *Colour*—Yellowish brown. (Sometimes whitened with lead carbonate.)
OTTO OF ROSES. *Ess. Oil.*	(ι) Spermaceti. (κ) Oil geranium.	Crystalline. If quite at rest, forming slowly, and in transparent needles. *Sulphuric Acid*—Does not affect the perfume.	In a mass of semi-opaque crystals. (ι) *S. Acid*—Gives a disagreeable odour. (κ)
IPECACUANHA. *Root.* (Fig. 52)	(λ) Striated ipecac. (Psychotria). Undulated ipecac. (μ) (Richardsonia).	Annulated root, with deep transverse depressions, but none longitudinal. Outer cortical portion brittle, resinous, not amylaceous. *Colour*—Brown-grey.	Large-jointed, with longitudinal striæ. (λ) Little emetina. Undulated, with slight depressions; white, starchy; friable cortex. (μ) *Colour*—Black, darkening by moisture (λ); bright brown. (μ)
CINCHONA CALISAYA. *Yellow Bark.* (Fig. 36.)	C. Carthagena. (Fig. 37.)	In thinnish pieces. *Ext.*—Epidermis, or bark-coat, absent, or of a tawny yellow, darker than the bark. *Colour*—Tawny yellow. *Fracture*—Close. (The only sure way to judge cinchona barks is to test for the amount of alkaloids.)	Generally thick. *Ext.*—Velvety; greyish *white*; thin, or soft, warty. *Colour*—Lighter; bright yellow. *Fracture*—Splintery.

CINCHONA CONDAMINEA. *Pale Bark.* (Fig. 39.)	“Grey” and rough barks. (Fig. 40.)	In small thin quills. *Lichens*—In abundance. *Colour*—Silvery grey. *Fissures*—Transverse, with acute edges.	Flat pieces, or large coarse quills. *Lichens*—None (or rarely present). *Colour*—Reddish brown. *Fissures*—Often absent, or very irregular.
ANTHEMIS NOBILIS. *Chamomile.* (Fig. 42.)	Matricaria chamomilla. *Common chamomile.*	Paleæ, or hairy scales, between each floret of the (yellow) disc. *Capitulum*, or head, solid pyramid.	No paleæ. *Head*—Hollow cone. (Only slightly convex in Matricaria Parthenium.)
JALAP. (Fig. 19.) Vera Cruz.	(ν) Jalap “Tampico.” (Fig. 20.) (ξ) Jalap (stalk or woody). (ο) Rose jalap. (π) Bryony root.	Tubers, round or egg-shaped, corrugated; heavy; dense. *Fracture*—Darkish, resinous; close texture; very hard and rough.	Long, furrowed, cylindrical, but irregular. (ν) Very *smooth* coat, dark brown, uniform colour. (π) Flat, dry, large excised pieces. (ο) *Fracture*—Fairly resinous, but not dense. (ν) White, soft, woody. (ξ) Amylaceous, with rose perfume. (ο)
SCAMMONY. *Gum resin.* (Fig. 66.)	(ρ) Chalk. (Fig. 66.*) (ς) Starch (τ) Gum, dextrine. (υ) Guaiacum resin. (φ) Jalap resin. (χ) Sand, earthy matters.	In irregular-sized lumps. Light, friable; pulverulent. Not affected by acid. Not affected by iodine. *Fracture*—Bright; translucent. *Colour*—EXT. greyish black. INT. green-black, with lustre. Forms emulsion with water. Unaffected by nitrous gas. Soluble in ether. Little or no *ash.*	In cakes, flat or round; regular (often). Heavy; hard; difficult to break up. (ρς) Effervesces with mineral acid. (ρ) Occasionally soft, moist, spongiform, or even mouldy. (τ) Decoction turned blue with iodine. (ς) *Fracture*—Dull. *Colour*—Light grey or whitish, speckled. Not liable to rub up with water. (ρς) Cold alc. or ether decoction is turned blue by nitrous gas. (ι) Insoluble in ether. (φ) Remains after incineration. (χ)

Fig 66 shows the pure Virgin or Smymù Scammony; Fig. 66 the adulterated or “Aleppo” sort.

SECT. I.—**Materia Medica**—*continued.*

Article of Materia Medica.	*Adulteration or Substitution.*	*Characters.*	
		Genuine.	*Spurious.*
RHEUM (PALMATUM ?) *Rhubarb.* (Fig. 11.) E. Indies, China.	Rhubarb, English. (Fig. 13.) „ European. (Fig. 12.) (Often believed to be sold as "Siberian;" known on the Continent as "Rhapontic.")	Heavy; close; dense texture. Mottled; marbled with red and white *intersecting* veins. *Odour*—Strong. *Taste*—Gritty.	Light; often spongy. Often brighter in colour, but with the pink and white rays *radiating* in a very regular manner. *Odour*—Weak and faint. *Taste*—Weak; no grittiness.
CINNAMON. *Bark.* (Fig. 35.	Cassia. *Bark.* (Fig. 34.)	Thin bark; cut at bottom of each quill. *Fracture*—Splintery. *Taste*—Delicate. *Length*—Often four feet long.	Thick; rough. *Fracture*—Close; almost resinous. *Taste*—Coarse. *Length*—Short; two to three feet at most; in bundles. Contains starch.
ALOES. (*Barbadoes.*) (Fig. 30.)	(ψ) Aloes, Mocha. (ω) „ cabalin, and other coarse qualities.	A pure description of aloes, generally in gourds. *Colour*—Clear liver. *Fracture*—Smooth; conchoidal. *Odour*—Not disagreeable.	Dark masses, in boxes or kegs; poor in quality. (ψ) *Colour*—Dark; rough. (ω) *Fracture*—Rough; unequal; irregular. *Odour*—Nauseous.
SARSA SMILAX. (*Jamaica.*) (Fig. 55.)	Sarsaparilla, Honduras. „ Lima. *Root.*	In bundles. Cortical portion, hard; slightly resinous. Many rootlets (or beard). *Colour*—Brown-red. No chumps.	Thin brittle epidermis. Cort. portion, mealy or starchy; large; takes up half the space of the root. Few rootlets. *Colour*—Brown; not trimmed. Sometimes with chump.

Crocus sativus. *Saffron.*	(α) Safflower (florets).	Narrow shreds, one inch long; style and three stigmas.	Shape of flower, or florets, &c. (α)
	(β) Marigold.		Ditto. (β)
	(γ) Old saffron, oiled.	Does not stain paper with grease.	Pressed between damp bibulous paper, it leaves stain upon the paper. (γ)
	(δ) Shreds of meat, &c.	Instantly colours saliva or water.	Placed in water, falls to the bottom; does not colour the water. (δ)
			Heat develops curious smell. (δ)
	(ε) Sand or lead.	Totally destroyed by fire.	Remains after incineration. (ε)

These are the principal adulterations; there are others, but they can generally be detected by the student being *practically* acquainted (and not merely from works on Materia Medica) with the appearance the drug presents when in a state perfectly pure and genuine.

SECTION II.

BOTANY.

Botany is a division of natural history, the study of which is generally distasteful to the beginner, though always fascinating to the adept—fascinating in *itself*, in the wonders it unfolds, in the secret beauties it brings to light, in the marvellous structures it discloses, constructed for a special purpose, and apparently bearing traces of a peculiar creative design—peculiarly fascinating also from the scenes into which it leads, and the intimate presence of nature with which it so vividly impresses the mind.

That the study of botany cannot be acquired from an abridgment, the author has come to a decided conclusion.

In the first place, an abridgment of this kind must be a collection of dry facts. Now these are, in botany, generally found to be more than usually uninteresting; it is only when they are fully illustrated by attendant explanations or familiar examples, or are themselves brought to light in the living specimen, that they interest and take firm hold of the mind. To attempt to teach botany from a bare detail of facts, injures both the science and the student: the former it robs of its beauty, the latter it disgusts and repels. The system is false from the beginning: it iguores the fact that information deprived of its attendant circumstances of interest is at the same time deprived of that which produces a lasting impression on the mind; it is the attempt to teach history by means of a chronological chart.

Charts, however, and abridgments are useful, *as far as they go.* A classified epitome of facts is of service when studying, with the aid of full and complete text-books, a branch of scientific knowledge: it shows the divisions of a subject on which more detailed information must be sought; it improves the faculty of observation by directing it to certain objects in a *systematic* manner; finally, this collection of facts (admittedly dry and uninteresting *per se*) furnishes definite points around which to group new ideas, fresh observations, or the results of careful and laborious investigation. A manual, elaborate in all its divisions, is, however, here an essential.

The pleasantest and surest way to learn a language is by "conversation;" at first phrases and examples, afterward from these the rules of grammar which they exemplify: we suggest the same method with respect to botany. From the careful examination of those articles of the Materia Medica which are already familiar to him, let the student gain a practical acquaintance with the nomenclature of organs and the arrangement of facts which constitute botany: from the example, to educe the rule; then let the rule, or *acquired* fact, be again demonstrated in the specimen before him.

PART I.—**Structural Botany.**

On looking over a collection of the principal Materia Medica (here we refer to parts of plants, not to *educts*, as gums or resins), we notice that the greater number are specimens of the root, the stem or its bark, or the leaves. If we take a living plant (out of the winter season), we always, with a few immaterial exceptions, find a root, a stem or trunk, and leaves. These three organs may therefore be considered as essential to the existence of the plant—a plant in reality consists of these parts: they are called Organs of *Nutrition*, because they severally contribute to its actual life. But we see other specimens, which can be neither of the above organs—Anthemidis flores, Crocus, Colocynthidis pulpa, Nux vomica: moreover, the organs of nutrition keep up the life of the individual plant, but the death of the individual is a necessity in "vital life;" it must therefore provide for the bringing into existence of a new plant similar to itself: the organs with this object are the Organs of *Reproduction*. These consist of the so-called flower, containing the ovary and ovule, which develop into the fruit with the seed; the latter produces the future individual.

In the examination, therefore, of a plant, we must consider, in the first place, its own existence; secondly, the means adopted for the continuance of the race; thirdly, the internal structure of the various organs.

Plants built up of cellular or vascular tissue may be divided as follows:—

Thallophytes, plants with a flattened expansion, as Algæ.

Cormophytes, *plants with a stem.*

Cryptogamia, or *flowerless* plants	Acrogenæ, or summit growers.
Phanerogamia, or *flowering* plants	Endogenæ, or inside growers. Exogenæ, or outside growers.

The various organs of a plant in its most perfect form may be classified as follows:—

(α) Organs of nutrition (necessary for life) . .	I. Root.	
	II. Stem.	
	III. Leaf.	
(β) Organs of reproduction (necessary for the formation of a new plant).	IV. Calyx.	
	V. Corolla.	
	VI. Stamens .	Filament. Anther. Pollen.
	VII. Pistil .	Ovary. Style. Stigma.
Changing to . .	VIII. Fruit.	
	IX. Seed.	

Examples.

Hellebore root (Fig. 50) has a rootstock, or rhizome, with an exterior contorted and knotty, with both transverse and longitudinal ridges; it has numerous fibrous *roots*, dark externally, with a light interior.

(*aa*) Sarza . . . (Fig. 55.)
(*a*) Rheum . . . (Fig. 12.)

The root of Pareira (Fig. 10) has, as an exception, layers that perfectly resemble medullary rays and woody zones: between the rays are triangular bundles of woody fibre and vessels.

The root of Aconite (Fig. 45) is conical in form, tapers to a point, and has a number of fine fibres proceeding from its sides. The shrivelling of this root on drying shows the internal *cellular* nature.

Calumba (Fig. 9) is the fasciculated, fusiform, tuberculated root. We may notice the yellowish grey rind, the depressed cellular centre, and the concentric layers.

Many orchids (2) . . . . . .

Chart.

ORGANS OF NUTRITION.

I. The Root.

The difference between a root and a stem may be given as follows:—

		Root.	*Stem.*
a.	1st growth . .	Downwards	Upwards.
b.	2nd growth . .	At the extremity . . .	At sides, inwards or outwards.
c.	3rd growth . .	Irregular branching of rootlets and absence of buds (*aa*).	Regular ramification from buds.
d.	Internal structure .	No pith or medullary rays (*a*)	Pith and regular formation.
e.	External structure .	No epidermis, stomata, leaves, or buds.	Epidermis, with stomata, leaves (generally), and buds (always).

In considering the various kinds of roots, we may class them as under (N.B.—For full descriptions, see a Manual of Botany):—

1° (*a*) True or tap root (primary).

(*β*) Adventitious root (secondary) { 1. Aerial.
2. Epiphytes.
3. Parasites.

2° The above, distinguished as . { 1. Monocotyledonous.
2. Dicotyledonous.
3. Acotyledonous.

1. (*a*) *True Root.*—This is formed by direct prolongation of the radicle; multiplication of cells by division takes place immediately under the layer of cells at the extreme termination; these "vital" cells push away the outer layer, and growth then proceeds in the cells behind them; the hard portion (vessels and wood-cells) then forms; it has a species of bark, and a cuticle (epiblema) when young.

(*β*) *Adventitious Root.*—Secondary, or *not* formed directly from the radicle; often fibrous, or as rootlets from the root proper.

1. *Aerial.*—Proceeding, through air, from branches to earth.
2. *Epiphytes.*—Roots in air, and deriving the food of the plant from the air.

	their support.	
	(α) Varieties of true or "tap" root—	
(a) Aconitum . . . (Fig. 45.)	Conical	As a cone (a).
(b) Radish. Gentianæ radix is cylindrical, or spindle-shaped, branched, and wrinkled . . . (Fig. 8.)	Fusiform	,, spindle (b).
(c) Turnip	Napiform	,, sphere (c).
	Placentiform.	
(d) Polygonum bistorta	Contorted (d).	
	Premorse.	
	(β) Varieties of adventitious root—	
(e) Sarza (rootlets of the rhizome), also most grasses . . . (Fig. 55.)	Fibrous	Tuft of long fibres (e).
	Coralline.	
(f) Jalapa. Oval *tubercules*, pointed more or less at extremities; covered with thin wrinkled epidemis (Fig. 19). Salep (in orchids).	Tuberculated (f).	
Calumba (before it is sliced)	Fasciculated.	
(g) Podophyllum (Fig. 54). This root, of the thickness of a quill, is knotted and jointed at intervals; the radicles may be seen, corrugated and wrinkled.	Nodulose	Fibres enlarged at one or more points, or swollen and knotted at intervals (g).
	Moniliform.	
(h) Ipecacuanha (Fig. 52). This root has a knotty appearance, in consequence of a number of deep circular fissures, extending inwards to a central ligneous cord, giving the idea of a number of rings, unequal in size, strung upon a thread.	Annulated	Many ridge-like thickened rings (h).

2. *The Root*, as—

All British forest-trees	1. ***Dicotyledonous.***—Formed by direct prolongation of the radicle.
Palms	2. ***Monocotyledonous.***—Given off, from one or several points, above base of the radicle. Their structure, internally, resembles that of the stem.
Ferns	3. ***Acotyledonous.***—The "spore" gives off a root at any point of the surface.

SECT. II.—Botany—*continued.*

Examples.

The structure and peculiarities of the stem will be seen in Juniperus Sabina (Fig. 179); the formation of an exogenous stem is that found in all our forest-trees; the arrangement is identical with that observed in the exceptional root of Pareira (Fig. 10), where may be distinguished the pith, wood in triangular bundles of woody tissue and vessels, medullary rays, and apparent epidermis or bark.

Bark.—In some of the specimens of yellow cinchona barks, the three layers are observable: in Carthagena cinchona bark (Fig. 37) the "liber," *aa*, is yellow-brown, and very fibrous; the cellular layer, *bb* (exterior), orange-red, and necessarily not fibrous; the suberous layer, *cc*, thin, whitish, and smooth. In *red* bark (Fig. 38) the mesophleum, *bb*, is cellular, the endophleum, *aa*, is fibrous and splintery, and the suberous layer, *cc* (forming the "warts") of a corky nature.

(*aa*) Cinchona . . (Figs. 36—40.)
(five various kinds)
Cinnamomum . . . (Fig. 35.)
Cassia . . . . (Fig. 34.)
Canella alba . . . (Fig. 73.)
Cascarilla . . . (Fig. 74.)
Simaruba . . . (Fig. 78.)
Angustura . . . (Fig. 75.)
The Cork-tree. The growth of the epiphleum forms the substance known as "cork."

Chart.

II. The Stem.

The ascending axis, bearing leaves and also the organs of reproduction; specially distinguished by the presence of leaves with leaf-buds in their axils.

1. Internal structure of Exogens.
2. " " Endogens.
3. " " Acrogens.
4. Buds, &c., varieties of Stems.

1. *Exogenous Stems*, or the structure of the stems of outside growers.

This great division of plants has stems which increase by additions on the outside of the wood. At first cellular, at the end of the first year they present the following parts:—

1. *Pith.*—Cellular tissue, in youth of tree filled with sap; large in *soft*, small or obliterated in *hard* wooded and old trees.
2. *Wood.*—Formed from the cambium layer, which consists of specially *vital* cells immediately within the bark. It comprehends—
   - *a.* The medullary sheath (spiral vessels) encircling the medulla ("marrow") or pith.
   - *b.* The woody tissue, formed of wood-cells, long, overlapping, and much thickened by deposits, with occasional pitted vessels. The wood proper is deposited in zones, generally well defined, one in each year, their number affording a clue to the tree's age.
   - *c.* Cambium layer of vital cells, containing elaborated nitrogenous sap.
3. *Medullary rays.*—Layers of tabular cells ("silver grain" of some woods) connecting the pith and inner bark, thus dividing the woody tissue into segments.
4. *Bark.*—Outer covering of the stem, growing by additions internally. It consists of (*aa*)—
   - *aa.* *Endophleum*, or inner coat—Liber, or bast-tissue of wood-cells.
   - *bb.* *Mesophleum*—Green, spongiform, cellular layer.
   - *cc.* *Epiphleum*, or "corky layer"—Dark, tabular cells; often much developed.
   - *d.* *Epidermis*—Cuticle.

Palms, *Grasses* . . . .
Sarza (*Fig.* 55). The internal structure of the rootlets much resembles an endogenous stem, but there is a central portion of compressed cells; there is also a woody portion and rind.

2. *Endogenous Stems*, or the structure of stems increasing by additions to the inside. No distinctions of parts, there being no true pith, bark, or regular zones of wood; fibro-vascular bundles (wood-cells, spiral and pitted vessels) being distributed irregularly throughout the cellular system, which itself assumes the appearance of wood through the thickening of the individual cells. These fibro-vascular bundles are in the growth of the tree forced outwards by the appearance of fresh bundles descending on the inside; on reaching the outside of the trunk or stem, these form, by their union, a false bark or rind. Thus the stem of such a plant is limited in its lateral expansion; it is generally very tall, and at the same time thin and slender.

Ferns, Tree-ferns . . . . .
[These are not known in England.]
Filix-mas . . . (Fig. 15.)

3. *Acrogenous Stems*, or those growing only at the summit. The stem peculiar to "flowerless plants." In mosses, &c., simply cellular; in the higher classes of ferns, a cellular mass with simultaneous vascular bundles arranged in wavy plate-like masses towards the outside; these bundles generally contain scalariform vessels. On the exterior is a rind, marked with scars of fallen leaves. These stems grow only from a *terminal* bud.

4. *Stems, their Accessories and Various Forms.*

1. *Buds.*—An "essential" of the stem, developed in axils of leaves or at apex of stem: the actual point at which a leaf is developed is a *node*, the interval between two nodes, an *internode*. Their formation is as follows: a portion of the bark swells out, covering a cellular process connected with the pith of the stem; vessels then surround it, and afterwards the bark, covering the cellular rudimentary leaves.

Soft in willow; resinous in fir . .

The coverings of the "bud" may be scaly, soft, resinous, or foliaceous. The variety of ways in which the leaf is folded in the bud is termed Vernation.

The existence of nodes and buds on an individual being naturally regular, the arrangement of the branches ought to be likewise regular: this is, however, not the case, from the abortion, or at other times the irregular increase of buds, which generally arises from an excess of active sap: these sometimes appear on leaves, &c. Nodules, or knobs, and excrescences, are simply these buds enclosed in the bark or wood.

2. *Varieties of Buds.*—Transformed buds are of several kinds:—

a. Thorn—A hardened pointed spine in axil of leaf, and connected with pith of stem.

b. Tendril—A twining, thin branch, destitute of leaves.

3. *Varieties of Stems*—A stem may be, according to its *character*—

Strong, growing by itself. Trunk, triangular, cylindrical; culm (in grasses); caudex or stipe (palms and tree-ferns).

Scammony (Convolvulus) . . .

Weak. Prostrate, ascending, climbing, &c.

Examples.

Strawberry (1). Mentha (4) . .

(*a*) Helleborus niger . (Fig. 187.)

(*a*) Filix-mas. Large, tufted, scaly; enveloped by the thickened bases of the stalks of the decayed leaves. (Fig. 15).

Zingiber . . . .

Curcuma . . . . (Fig. 49.)

Veratrum album. Fleshy, cylindrical. (Fig. 58).

(*b*) Many grasses. Sarza (Fig. 55), tuberous subterranean stem or chump.

(*c*) Potato . . . .

Scilla . . . (Fig. 3, "sliced.")

(*a*) Colchicum (Fig. 121, "sliced.") (Fig. 199.)

Compare the leaves of Digitalis (Fig. 189), or Conium (*aa*), with those of Crocus (Fig. 200) (*bb*), or of a fern (*cc*).

In the rose we notice the lamina (*a*), the stipules (*b*), and the petiole (*c*).

(*aa*) Digitalis . . (Fig. 189.)
(*bb*) Colchicum . . (Fig. 199.)
Crocus sativus . (Fig. 200.)
(*cc*) N. O. Filices . . . . .

Chart.

The various unusual forms assumed by stems may be classified as follows:—

(*a*) Aerial.
(*b*) Subterranean.

(*a*) **Aerial stems or branches.**

1. Runner. 2. Offset. 3. Stolon. 4. Sucker.

(*b*) Subterranean stems.

1. Rhizome (*a*)—Thickened, prostrate, burrowing; in the large majority of medicinal rhizomes they are wholly subterranean.

2. Creeper (*b*).

3. Tuber—Stem (*c*) enlarged at certain points.
4. Bulb—Shortened stem, surrounded by scales. By some considered as a bud.
5. Corm—A *solid* bulb; enlarged solid oval stem, or "base of stem" (Lindley); often amylaceous (*a*).

III. The Leaf.

The leaf is a lateral expansion of the cellular tissue of the stem-circumference, with the veins as a continuance of the vascular system. We may consider the leaf under three heads:—

1. Arrangement in the general symmetry of the plant.
2. Outward form.
3. Internal structure.

1. *Arrangement, &c.*

Variations of the leaves in—

	(*aa*) *Dicotyledonous.*	(*bb*) *Monocotyledonous.*	(*cc*) *Acotyledonous Plants.*
Venation . .	. Reticulated . .	. Parallel or fan-shaped .	. Forked.
Articulation .	. Generally present	. Absent	. Absent.
Stipules .	. Often present .	. Absent (sometimes "ligules")	. Absent.
Margin . .	. Indented . . .	. Entire	. Much cut.
Arrangement .	. Compound or simple .	. Simple	. Compound.

A leaf consists of (*a*) lamina, or blade.
(*b*) stipules (if absent, the leaf is exstipulate), or leaflets at the articulation.
(*c*) petiole (if absent, the leaf is sessile), or leaf-stalk.

With regard to leaf-symmetry, we can only touch on the principal heads:—

a. Insertion.

The following are terms in use relative to insertion:—

Embracing—Enlarged petiole, clasping the stem (*aaa*).
Sheathing.
Perfoliate.
Connate—Two leaves uniting (*bb*).

Conium maculatum (*aaa*) (Fig. 196.)

Some Honeysuckles (*bb*) . . .

b. Arrangement.—Leaves may be alternate, opposite, whorled, &c., &c.

c. Vernation.—This is the manner in which the leaf is folded in the bud. The *terms* used have reference to the individual, or their relation as a whole, either as bent or rolled; they are numerous, and should be carefully studied.

2. *Form of the Leaf.*

1. *Lamina*, or blade.—The veins (midrib and ribs) are either reticulated, parallel, or forked.

Senna . . . (Figs. 83 and 84.)

The leaf may be—

(*a*) Simple, as *Digitalis*.

(*b*) Compound, as *Conium*.

Buchu (dotted with glands on under surface) . . . . (Fig. 81.)
Uva Ursi . . . . (Fig. 82.)

(*a*) In examining a simple leaf, we must consider—

α Margin and Apex. Of these there are many varieties, to which have been given various names; these are of much importance in the description of medicinal plants. The margin may be incised, much (*aa*), or scarcely at all (*bb*).

Matico . . . . . (Fig. 68.)
Lobelia . . . . . (Fig. 67.)

Aconitum (*aa*). Much divided margin, palmately cleft . (Fig. 188.)
Belladonna (*bb*). Margin scarcely incised (Fig. 192.)

β Shape, as lanceolate, oblique (unequal), ovate (egg-shaped); peltate, oval, &c.; or *solid*, as cylindrical, pitcher-shaped (transformed petiole, the lid being the lamina), &c.

(*b*) Compound leaf, a leaf of many separate portions.

α Pinnately, as *Acacia*, *Conium*.

β Palmately.

Conium (*α*). Tripinnate, with lanceolate, pinnatifid leaflets (*c*). (Fig. 196.)
Horse-chestnut, Trefoil (*β*) . . .

Examples.

Hyoscyamus (Fig. 191) and Stramonium (Fig. 193) are simple, and have their margins much incised.

In Belladonna, a good example of a *simple* leaf, the petiole and lamina are well observed . . (Fig. 192.)

Sabina (Fig. 197). Leaves ovate, small, closely investing the stem.

As illustrations of these organs, see the botanical plates, Figs. 187—200.

Chart.

2. ***Petiole***, or leaf-stalk.—With articulations, long or short, generally thin; sometimes sheathing. It has a fibro-vascular system, surrounded with parenchyma; ***pulvinus***, swelling at base of petiole; ***ligule***, membranous appendage, sometimes divided, terminating the sheathing; widened petiole in grasses; sometimes leaf-like and flattened.

3. *Stipules.*—Small leaflets at either side of the base of the petiole. Lateral development, occasionally of large size (Pea); sheathing, forming an "ochrea" (Rheum); interpetiolar (Cinchona), growing *between* two opposite leaves.

3. *The Structure of a Leaf* consists of (*a*) cellular system.
(*b*) fibro-vascular system.

(*a*) Cellular system. This surrounds the fibro-vascular ramifications in two layers; the cells contain chlorophyll, and are often loosely connected.

(*b*) Fibro-vascular system. Upper and lower arrangement; the former in connexion with woody layer, the latter with liber, or inner bark. Submerged leaves are destitute of these vessels.

The epidermis is on both sides; the stomata, chiefly on the under side: the articulation of the leaf is the point at which the petiole joins the stem, and here is generally noticed a contraction of parenchyma.

ORGANS OF REPRODUCTION.

These are the organs or parts of the plant *not* necessary to its actual life, but essential to its reproduction, or to the production of another individual similar to itself.

In the flowering plants, they consist of—

A. The floral envelopes { IV. Calyx.
V. Corolla.
B. Essential organs . { VI. Stamens, or male organs.
VII. Pistil, or female organ.
Their union producing . { VIII. Fruit, containing
IX. Seed.

In the flowerless plants they are obscure, in most instances consisting essentially of ***spores***.

In the examination of the organs in the Phanerogamia, or flowering plants, we will first take a brief view of the flower, in the relation in which they stand to each other, when taken as a whole in the several different arrangements on the floral axis. This is termed Inflorescence, and is of three kinds:—

should be noticed as examples of the various kinds of inflorescence:—

where the outer flowers, or those lowest on the floral axis, open *before* those above them, or nearer the centre: from without, inwards.

(*a*) With an elongated primary axis—

Varieties of the Spike.	1. Spike . . .	Sessile flowers on lengthened stalk.	Plantago, or Rib-grass. Verbascum . (Fig. 190).
	2. Amentum . .	Spike, with male *or* female flowers, with scaly bracts, becoming detached as a whole.	Willow . . . .
	3. Locusta . . .	Spikelet of grasses, with paleæ and glumes (bracts) in place of floral envelopes.	Grasses . . . .
	4. Spadix . . .	A succulent spike, with bractless flowers, enclosed in a sheathing bract, or spathe.	Arum; many Palms . . . . .
	5. Cone . . .	A *compressed* spike of female flowers, each with scaly, woody bract.	Fir, Pine, &c., (N. O. Coniferæ) . .
	6. Strobile . . .	As above, but with membranous bracts.	Lupulus (Hop) . . . . . .
	7. Raceme . . .	Flowers on secondary stalks or pedicels, arranged spike-like.	Hyacinth. Aconitum . (Fig. 186.)
	8. Corymb . . .	A raceme, in which the lower flowers have longer pedicls than the upper, forming a level top.	Cerasus (Cherry) . . . . .
	9. Panicle.		Oat . . . .
	10. Thyrse.		Vine . . . .

(*b*) With a dilated axis—

11. Capitulum . . .	Head of sessile flowers, surrounded by row of bracts (or "involucre").	Anthemis (N. O. Compositæ). Many-flowered head . . (Fig. 42.)
12. Umbel	Numerous pedicels, as *radii*, from the same point of the shortened axis.	N. O. Umbelliferæ; Conium (Fig. 196); Æthusa . . . (Fig. 195.)

2. *Definite or Centrifugal Inflorescence.*—A terminal bud, which opens first, those away from centre (or lower on primary axis) afterwards. The varieties of inflorescence under this head are varieties of the *cyme.*

13. Cyme	Corymb-like cluster, the flowers, however, opening centrifugally.	Sambucus nigra . . . . .
14. Scorpioid cyme . .	The flower-buds on *one* side only of terminal bud being developed.	Heliotrope, Borage . . . .

There are several other varieties of cyme, sessile, contracted, &c.

3. *Mixed Inflorescence.*—A mixture of the above, as in Compositæ, where the capitula, as a whole, develop centrifugally, each capitulum, however, in a centripetal manner.

4. *Bracts* (*a*), *&c.; Peduncle* (*b*).—Before the examination of the floral envelopes, we may mention.

Examples.	*Chart.*
Bracts may be observed in many plants, of various forms, immediately inferior to the flower; see Digitalis (Fig. 189.)	(*a*) Bracts, or floral leaves; it is in their axils that appear the flower-buds: they are leafy, rarely coloured; membranous, as in cone; scaly, as in hop; hard, as in husk of filbert and cup (cupule) of acorn; fleshy, as in pine-apple. When in a circle round one or more flowers, they are termed an *involucre;* when sheathing a spadix, a *spathe,* at the base of a locusta, *glumes.* (*b*) The Peduncle is the primary floral axis, pedicels the secondary and tertiary: if radical, it is a *scape;* if elongated, a *rachis;* if flattened, a *receptacle* (as in Ficus). (*c*) Æstivation is, as vernation to leaves, the arrangement of the flower-leaves (sepals and petals) in the flower-bud.
	A. THE FLORAL ENVELOPES.
Anthemis . . . . . (Fig. 42.) Cusso . . . . . . (Fig. 41.) Aconitum . . . . (Fig. 188.)	These consist of—IV. Calyx. V. Corolla.
Petalloid in Helleborus niger (Fig. 187.) (*aa*) Crocus sativus, N. O. Liliaceæ, &c. (Fig. 200.) Colchicum . . . . (Fig. 199.)	IV. **The Calyx.**—The outer whorl, generally green. Its component *leaves* are termed *sepals.* When they are *petalloid,* or coloured so as to resemble the petals, the whole circle is termed *perianth* (*aa*). This principally occurs in endogenous plants. The calyx is either— (*a*) Polysepalous, or with several separate sepals; or (*b*) Monosepalous, or the sepals *united.*
Irregular in Aconitum napellus, where it is petalloid, with the upper sepal concave and helmet-shaped (Fig. 188.)	(*a*) This may be regular (sepals equal in size, form) or irregular.
Regular (pitcher) in Hyoscyamus; irregular in Lamium (white Dead Nettle)	(*b*) This calyx may be *cleft* or entire, with complete union; it comprehends the *tube, limb* (free portion), and *throat.* It may be regular (tubular, pitcher-shaped, &c.), or irregular (bilabiate, &c.).
N. O. Papaveraceæ (*aa*) . . . . (*c*) Apple; Rose . . . . . . (*d*) Digitalis . . . (Fig. 189.) (*e*) Aconitum . . . (Fig. 188.)	The calyx is *superior* when above and adherent to the ovary; (*c*) *inferior,* if below and encircling it; (*d*) *pappose,* when hairy and adherent to ovary, as in many of Compositæ; *hooded,* in Aconitum (*e*); *saccate* or *spurred,* when irregularly expanded into a bag or a spur; *caducous,* when it falls off before development of flowers (*aa*). The Epicalyx, if present, is an outer calyx.

V. **The Corolla.**—The bright-coloured part of the flower; petalloid, and therefore showy. It consists of petals: these may be separate (*a*), or united (*b*).

(*a*) Polypetalous. Petals separate.

1. Regular. Cruciform, rosaceous (five petals, short claws).

2. Irregular. Papilionaceous (five petals—one large, two inferior, two lateral).

(*b*) Monopetalous. Petals united.

1. Regular. Campanulate (bell-shaped, as in Belladonna), tubular (many Compositæ, florets of "ray"), rotate (Solanum Dulcamara), &c.

2. Irregular. Labiate, or lipped; personate, or masked (in Snap-dragon); ligulate, or strap-shaped (Compositæ, florets of "disc"); digitaliform, or glove-shaped.

The corolla, as the calyx, may be superior or inferior, with reference to the ovary; it may be spurred, hooded; it may have scales or nectaries on its inner base.

(*a*) 1, Cruciform in N. O. Cruciferæ; 2, irregular ("hooded") in Aconitum (Fig. 188.)

Papilionaceous in many Leguminosæ .

(*b*) 1, Regular, rotate in Solanum (Fig. 194), campanulate in Atropa (Fig. 192); 2, Labiate in N. O. Labiatæ (Fig. 189.)

Digitaliform in Digitalis purpurea; ligulate and tubular in Anthemis. (Fig. 42.)

Tubular and bilabiate in Helleborus niger. . . . . (Fig. 187.)

B. THE ESSENTIAL ORGANS OF REPRODUCTION.

These consist of—VI. Andrœcium, or Stamens.
VII. Gynœcium, or Pistil.

A flower may be hermaphrodite (stamens *and* pistil), unisexual (either stamens *or* pistil), or neuter (neither).

A plant may be monœcious (*aa*) (with unisexual flowers, both male and female), diœcious (male and female on different plants), or polygamous (both unisexual, male and female, and hermaphrodite flowers on same plant).

The "disc" is an organ, seldom present, between the stamens and the pistil.

VI. **The Stamens.**—These may be considered as the *male* organs of the plant; for the active influence of the *pollen* from the stamens is necessary to the fertilization of the ovule. The stamen consists of—(*a*) filament;
(*b*) anther;
(*c*) pollen.

(*aa*) Ricinus communis. The flowers are in long racemes: the lower male, or stamenate; the upper female, or pistillate.

Ecbalium officinarum (the Squirting cucumber) is also monœcious.

Atropa Belladonna. . (Fig. 192.)

Examples.	*Chart.*
	(*a*) *The Stalk.* Occasionally wanting, generally long and cylindrical. Its junction with the anther may be—
N. O. Ranunculaceæ (1)	(1) Along the back of the two lobes, causing an *adnate* anther.
N. O. Papaveraceæ (2)	(2) At the base of lobes only, causing an *innate* anther.
N. O. Rosaceæ (3)	(3) At centre of anther, at a single point, causing a *versatile* anther.
N. O. Liliaceæ (generally) (*bb*) . . N. O. Iridaceæ (*aa*), Melanthaceæ . .	(*b*) *The Anther.* Divided in two lobes, each generally two-celled; joined by the connective. These lobes, usually oval, are sometimes of various shapes and sizes, and in most plants of a yellow colour; they are *extrorse* (*aa*), if turned away from the pistil; *introrse* (*bb*), if with their face towards the centre of the flower. The anther, when ripe, opens usually each lobe longitudinally, and discharges the pollen.
	(*c*) *Pollen.* Cells, or pollen-grains, formed in the lobes of the anther; usually separate, occasionally in masses. The pollen-grain has two coats, the *extine* and the *intine*; it is generally round or oval, and contains a granular nitrogenous matter, *fovilla.* When the pollen-grain falls on the stigma of the pistil, the extine opens, and the intine protrudes as a tube. This, proceeding down the conducting tissue of the style, reaches and impregnates the ovule.
	In examining the stamens in their relations to each other, the following are a few of the principal terms employed:—
	1. Situation.
	Hypogynous (*a*) . . . Arising from *below* the pistil.
	Perigynous (*b*) . . . Situated round the pistil, adhering to the calyx.
	Epigynous (*c*) . . . Growing *upon* the pistil (ovary).
Digitalis (*d*) . . . (Fig. 189.)	Epipetalous (*d*) . . . Upon the corolla.
The flowers of N. O. Orchidaceæ have only one column, comprising the pistil and stamens (*e*) . . .	Gynandrous (*e*) . . . Forming one column with the gynœcium (pistil).
	2. Number and union.
	Monandrous (*f*) . . . One stamen.
	Diandrous (*g*) . . . Two stamens, &c.
N. O. Compositæ (*h*)	Syngenesious (*h*). . . Anthers only united, filaments free.
Malva (*i*)	Monadelphous (*i*) . . . Filaments united in one bundle.
Papilionaceæ (ten stamens, nine in one bundle, one separate) (*j*) . .	Diadelphous (*j*) . . . Filaments united in two bundles.
	3. Relative length.
N. O. Cruciferæ (*k*)	Tetradynamous (*k*) . . . Six stamens—*two* short, *four* long.
N. O. Labiatæ, Scrophulariaceæ (Digitalis) (*l*) . . (Fig. 189.)	Didynamous (*l*) . . . Four stamens—*two* short, *two* long.

The fruit ("bladder") of the Senna (Fig. 84) clearly proves that the carpel is a modified leaf.

Atropa Belladonna . . (Fig. 192.)
Crocus sativus. The stigmata, with remains of the styles; the stigma tripartite, expanded and notched; the style narrow and capillary. (Fig. 200.)

At the summit of the poppy-capsule is the sessile stigma (*b*).

(*aa*) Digitalis . . (Fig. 189.)
(*bb*) Rosa . . . .

In the "legume" of Cassia fistula (Fig. 16) are false dissepiments, called *phragmata*.

(1) Atropa Belladonna . (Fig. 192.)
Colchicum . . . (Fig. 199.)

The specimens of fruit given later on are also specimens of ovaries, in many cases modified in the process of ripening, but still to a great degree preserving their original form.

In orange (*Aurantium*) (Fig. 79). 1, peel; 2, white layer; 3, membranous partitions; the "pulp" consists of enlarged succulent placenta.

In plum (*Prunus*). 1, skin; 2, pulp; 3, stone.

VII. **The Pistil.**—The female organ of reproduction.

It consists of folded carpels, one or more, distinct (apocarpous) or united (syncarpous); ***simple*** if of one, ***compound*** if of several. The carpel represents a folded modified leaf; the back is the ***dorsal suture***, the face (or union of margins) the ***ventral suture***. Thus, in a simple ovary, carpel and ovary are synonymous and convertible terms.

(*a*) ***The Style*** (or column), supporting the stigma, not always present, consisting, interiorly, of loose cellular ***conducting*** tissue.

(*b*) ***The Stigma*** (or the apex of style), generally covered with a viscid fluid, to hold the pollen-grains; a prolongation of the style; a flattened expansion of the conducting tissue.

(*c*) ***The Ovary.*** This contains the ovule, or future seed. It is at the base of the style; superior (*aa*) or inferior (*bb*) to the calyx.

A flower is monogynous (one carpel or style), digynous (two carpels), &c., &c.

The pistil, when *compound*, may be, as above mentioned, apocarpous (carpels distinct), or syncarpous (carpels united); the compound ovary (as opposed to the compound pistil), consisting of several ovaries (*i. e.*, several carpels) in perfect union, forming one body and one ovary. This compound ovary has, therefore, cavities, or loculi, divided by walls, or ***dissepiments*** (*i. e.*, margins of carpels), or, by their union, may be unilocular. At the ventral suture of each carpel is a cellular growth, called the *placenta*, to which is attached the ***ovule:*** (1) ***axile***, or on axis, in compound many-celled ovaries; (2) ***parietal***, or on walls; or (3) ***free central***, on central axis, in one-celled compound ovaries.

The Ovule, or the future seed; situated, one or more, in an ovary, or occasionally naked. In ovary, either sessile on the placenta, or attached by a cord, or funiculus (***raphe***, when elongated and adhering to ovule), appearing at first as a round nucleus. It may, on development, be straight, curved, or inverted. The ***micropyle*** is the orifice at apex of nucleus; the ***chalaza***, the connecting link with the ovary-wall; the ***hilum***, point of attachment to placenta.

VIII. **The Fruit.**—The ovary after the fertilization of the ovale; it generally (but with exceptions) has the same structure. It is as the ovary, superior or inferior, simple and compound, apocarpous and syncarpous.

It has two parts—*α* Pericarp.
β Seeds.

Examples.

In almond (*Amygdalus*). 1, skin; 2, green layer; 3, woody shell.

In Colocynthis (Fig. 44), the so-called pulp is the endocarp, the epi- and mesocarp having been pared off.

In Bela (Fig. 43), the three coats can be well noticed.

(*b*) *Transverse* dehiscence is well shown in fruit of Hyoscyamus; (*c*) *porous* in capsule of Papaver (Fig. 191.)

(*a*) Valvular in Aconitum (Fig. 188.)

1. N. O. Leguminosæ. (*a*) . . . .
2. Cassia fistula . . . (Fig. 16.)
3. Peach . . . .
   Oliva, Prunus . . . . .

5. Aconitum (Fig. 188); Helleborus .

Chart.

a Pericarp, or shell; with three layers
- 1. Epicarp, or outer coat.
- 2. Mesocarp; if fleshy, sarcocarp.
- 3. Endocarp; if stony, putamen.

The fruit opens, generally at one or both sutures of the carpels, but in various ways: where this opening, or dehiscence, does not occur, the fruit is *indehiscent.*

Dehiscence—At sutures, or junction of carpels; this may be either—

(*a*) Valvular—
(1) Septicidal, down either dissepiment.
(2) Loculicidal, by dorsal sutures.
(3) Septifragal, by dorsal sutures, breaking away from and leaving the dissepiments.

b Transverse—By a transverse line, the top coming off like a lid.
c Porous—By holes or pores in the fruit.

There are many varieties of fruit: we will name a few of the most important ones, following here the arrangement of Professor Bentley. For the important study of the various sorts, a full description is necessary: this can be found only in a complete Manual of Botany.

A. Fruits from one flower.
B. Fruits from numerous flowers combined.

A. *Fruit from one Flower*—

I. Simple fruit.
II. Apocarpous fruit.
III. Syncarpous fruit.

I. *Simple Fruit.*—A single carpel in a single flower.

1. Legume, or pod	*Two*-valved, various shaped (*a*).
2. Lomentum .	Legume contracted at points.
3. Drupe . .	Stone-fruit. Fleshy, indehiscent.
4. Utricle .	One-celled, with membranous pericarp.

II. *Apocarpous Fruit*—Several carpels, *distinct*, in a single flower.

5. Follicle .	Superior, one-celled, one or many seeded, one-valved. Several produced by one flower.

6. N. O. Labiatæ		6. Achenium	One-celled, one-seeded, with dry indehiscent pericarp.
		7. Etærio	A collection of achenia in zone, as in Strawberry.

III. *Syncarpous Fruit.*

8. N. O. Graminaceæ	Superior	8. Caryopsis	One-celled, one-seeded, indehiscent; pericarp united with seed.
9. Datura Stramonium (Fig. 193.) Papaver (globose, obovate, papyraceous, with remains of the star-like stigma), Cardamomum (Fig. 70.) Hyoscyamus niger (Fig. 191.)		9. Capsule	One-, or more, celled, many-seeded, dry, dehiscent.
10, 11. Many of N. O. Cruciferæ		10. Siliqua	Long, narrow, dehiscing in a valvular manner, &c.
		11. Silicula	As siliqua, but short and broad.
12. Aurantium		12. Hesperidium	Many-celled, indehiscent.
13. Peculiar to N. O. Umbelliferæ, *ex. gr.*, Conium (Figs. 196 & 128.) Fœniculum (Fig. 124.) Coriandrum (Fig. 125.) Carum (Fig. 126.) Anethum (Fig. 127.)	Inferior	13. Cremocarp	Dry, indehiscent, two-celled, two-seeded, on "carpophore" or axis.
14. Acorn		14. Glans, or nut	Hard, dry, one-celled, with the three layers of pericarp firmly coherent; often surrounded with capsule.
15. Piper nigrum (Fig. 72.) Capsicum (Fig. 85.) Solanum Dulcamara (Fig. 194.) Atropa Belladonna (Fig. 192.)		15. Bacca	Berry; indehiscent, many-seeded, pulpy.
16. Ecbalium (the fruit of the "Squirting Cucumber," which gives Elaterium) Colocynthis (thin rind, globose, large) (Fig. 44.)		16. Pepo	One (or spuriously three) celled, many-seeded, pulpy or fleshy.
17. Apple, Cydonia		17. Pome	Indehiscent, two or more scaly carpels, covered by fleshy mass.

B. *Fruit from several Flowers combined.*

18. Fir, Pine (N. O. Coniferæ)	18. Cone	Collective head, generally conical, of numerous hard membranous bracts, covering *naked seeds.*
19. Cupressus (Fig. 198.) Juniperus Sabina (Fig. 197).	19. Galbulus	Small rounded cone, with succulent enlarged scales.

Examples.	*Chart*	
20. **Lupulus.** Membranous, persistent bracts (scales), having at their base small hard achenia, covered with round aromatic glands of *Lupuline* .	20. Strobile .	Membranous cone, but with seeds enclosed in *ovaries.*
21. Pine-apple, Morus.	21. Sorosis .	Fleshy mass, on thalamus (or receptacle).
22. Ficus	22. Syconas .	Enlarged succulent receptacle, bearing numerous flowers and ovaries with ovules.

"Myristica" (Fig. 24), which is the seed itself removed from the "arillode" (*aa*) and shell, or "fruit," consists of oily albumen, marbled, with the endopleura (*bb*) dipping down into it.

Nux vomica (Fig. 29) is a good example of a seed. In the centre of concave side is an elevated point, the hilum (*l*); from this point a slight ridge, the raphe (*i*), runs to a slight prominence at the circumference, the chalaza (*k*). It has two coats, a fibrous ash-grey testa (*a*) with silky hairs (*b*); thin endopleura (*c*). The nucleus, on cutting the seed open, consists of bipartite albumen (*d*), horny (*e*), with an embryo (*m*), having a radicle (*f*), plumule (*g*), and two large, thin, heart-shaped cotyledons (*h*)

Myristica (Fig. 24.) Areca Catechu (Fig. 23.)	Examples of ruminated albumen (*n*).

Gran. Parad. (Guinea pepper). (Fig. 59.)

IX. **The Seed.**—The ovule, enclosed in the ovary (or sometimes naked), on being fertilized by the fovilla of the pollen, becomes the seed.

The Seed is the ovule after fertilization: similar to it in internal structure, but externally differing much, as regards shape, size, colour, &c.

We will consider—I. Coats.
II. Nucleus.

I. *Coats of Seeds.*

Two in number
- 1. *Testa* (*a*), outer, thickened coat, soft, woody, fleshy, hairy (*b*), &c.
- 2. *Endopleura* (*c*), inner coat, thin and delicate (*bb*).

The Arillus is a false coat, occasionally seen, *ex. gr.*, Mace, covering the nutmeg (*aa*).

II. *Nucleus* .
- 1. Albumen (*d*), often absent, surrounding the embryo.
  - Of various natures . .
    - horny, in Nux vomica (*e*).
    - starchy, in wheat (Triticum).
    - oily, in Ricinus.
    - ruminated (mottled), in nutmeg, (*n*).
- 2. Embryo (*m*) or rudimentary plant
  - *radicle*, or root, growing downwards (*f*).
  - *plumule*, or stem, growing upwards (*g*).
  - *cotyledons*, one or two; one or two fleshy (*h*) nursing leaves, lobes.

The seed, as the ovule, may possess a raphe (*i*), chalaza (*k*), and hilum (*l*).

INTERNAL STRUCTURE.

All vegetable tissue is built up of the cell, modified or altered by circumstances. The typical cell is spherical; an elongated and strengthened modification is the vessel.

A leaf consists of (*a*) lamina, or blade.
(*b*) stipules (if absent, the leaf is exstipulate), or leaflets at the articulation.
(*c*) petiole (if absent, the leaf is sessile), or leaf-stalk.

With regard to leaf-symmetry, we can only touch on the principal heads:—

a. *Insertion.*

The following are terms in use relative to insertion:—

Embracing—Enlarged petiole, clasping the stem (*aaa*).
Sheathing.
Perfoliate.
Connate—Two leaves uniting (*bb*).

Conium maculatum (*aaa*) (Fig. 196.)

Some Honeysuckles (*bb*) . . .

b. *Arrangement.*—Leaves may be alternate, opposite, whorled, &c., &c.

c. *Vernation.*—This is the manner in which the leaf is folded in the bud. The *terms* used have reference to the individual, or their relation as a whole, either as bent or rolled; they are numerous, and should be carefully studied.

2. *Form of the Leaf.*

1. *Lamina*, or blade.—The veins (midrib and ribs) are either reticulated, parallel, or forked.

Senna . . . (Figs. 83 and 84.)

The leaf may be—

(*a*) Simple, as *Digitalis*.

(*b*) Compound, as *Conium*.

Buchu (dotted with glands on under surface) . . . . (Fig. 81.)
Uva Ursi . . . . (Fig. 82.)

(*a*) In examining a simple leaf, we must consider—

α Margin and Apex. Of these there are many varieties, to which have been given various names; these are of much importance in the description of medicinal plants. The margin may be incised, much (*aa*), or scarcely at all (*bb*).

Matico . . . . . (Fig. 68.)
Lobelia . . . . . (Fig. 67.)

β Shape, as lanceolate, oblique (unequal), ovate (egg-shaped); peltate, oval, &c.; or *solid*, as cylindrical, pitcher-shaped (transformed petiole, the lid being the lamina), &c.

Aconitum (*aa*). Much divided margin, palmately cleft . (Fig. 188.)
Belladonna (*bb*). Margin scarcely incised (Fig. 192.)

(*b*) Compound leaf, a leaf of many separate portions.

α Pinnately, as *Acacia*, *Conium*.

β Palmately.

Conium (α). Tripinnate, with lanceolate, pinnatifid leaflets (*c*) . (Fig. 196.)
Horse-chestnut, Trefoil (β) . . .

PART II.—**Classification.**

There have been, at successive stages in the history of the science of Botany, several different systems in the arrangement of plants. The Linnæan was an artificial classification, from the number of stamens and pistils; the *natural* system, introduced by Jussieu, improved by De Candolle, and further amended by Lindley, is, with modifications, the one in general use at the present day. Its essential principle consists in the grouping of plants according to their general structure and evident resemblance in organs and properties. The arrangement adopted in this work is that given by Professor Bentley, which seems the most satisfactory yet published.

In this classification, individual plants are arranged in *orders*, most justly called *natural;* these orders are subdivided into ***genera*** and ***species.***

SPECIES consist of individuals resembling each other in every respect, reproducing the same essential character by seed. (Atropa) *Belladonna.*

GENERA.—Several species, much resembling each other in organs of reproduction. *Atropa.*

NATURAL ORDER.—Genera that have the same fruit, or some marked features or properties in common. N. O. ***Umbelliferæ, Graminaceæ.***

CLASS.—Natural orders that have the same *internal structure, ex. gr.*, Dicotyledonæ.

SUB-CLASS.—A division, for convenience, in a class.

Class.	*Division.*		*Sub-Class.*
I. DICOTYLEDONÆ	1. Angiospermæ (ovules in ovary)	(α) Thalamifloræ	Stamens hypogynous.
		(β) Calicyfloræ	Stamens perigynous or epigynous.
		(γ) Corollifloræ	Corolla monopetalous; stamens on corolla or ovary, or free and arising from thalamus.
		(δ) Monoclamydeæ	One floral envelope only.
	2. Gymnospermæ (ovules naked).		
II. MONOCOTYLEDONÆ		(ε) Dictyogenæ.	
		(ζ) Petaloideæ	With coloured floral envelopes.
		(η) Glumaceæ	As grasses.
III. ACOTYLEDONÆ		(θ) Acrogenæ	With stems.
		(ι) Thallogenæ	With flattened expansion, or *thallus.*

NATURAL ORDERS.

The following are the essential features of the principal Natural Orders which embrace the plants mentioned in the Pharmacopœia: the officinal plants are mentioned under each natural order in the Section of Materia Medica. (*The characteristic features peculiar to the order are in heavy Egyptian type*). For the signification of terms, see Division on "Structural Botany."

RANUNCULACEÆ . LEAVES.—Alternate or opposite, generally much divided.
Petioles.—Sheathing and dilated.
Stipules.—**None distinct from petiole.**
COROLLA.—**Imbricated** (the folding of the petals in flower-bud).
STAMENS.—**Hypogynous.**
Anthers.—**Adnate.**
FRUIT.—**Apocarpous**; follicles or achenia (carpels distinct).
SEED.—*Albumen*, **Horny.**
SAP.—Watery.
Example.—Ranunculus; Helleborus (Fig. 187); Aconitum (Fig. 188).

NYMPHACEÆ . . . . . . PLANTS.—**Aquatic.**
LEAVES.—Floating, circular, peltate.
CALYX AND COROLLA.—Passing, by degrees, into stamens and pistil, some of which are often petalloid.
DISC.—Encircling ovary.
STIGMA.—**Sessile, radiating.**
FRUIT.—**Of the united carpels, superior, many-celled,** with **seeds attached** to **perfect dissepiments.**
SEED.—With mealy albumen.
Example.—Nymphæa (water-lily).

(The characters in N. O. Nelumbiaceæ are similar to above, but the fruit are **numerous two-celled "nuts," in the cells of a honeycombed thalamus,** or receptacle.)

PAPAVERACEÆ . . . . . LEAVES.—Alternate, exstipulate.
CALYX.—**Two**, or rarely three, sepals; **deciduous** (falling off on the expansion of the corolla).
COROLLA.—Four petals, generally plicate (in folded flower-bud).
STAMENS.—**Numerous innate anthers.**
STIGMA.—Two or numerous, radiating, often sessile.
FRUIT.—**One-celled compound capsule, with many seeds on parietal placentæ.**
SEEDS.—Numerous, **with oily albumen.**
SAP.—**Milky.**
Example.—Papaver (poppy).

CRUCIFERÆ . . . . PLANTS.—Herbs.

LEAVES.—**Alternate, exstipulate.**
CALYX.—**Four sepals.**
COROLLA.—**Four petals, in a cruciform manner.**
STAMENS.—**Six, tetradynamous, four long and two short.**
STIGMA.—Two stigmata.
FRUIT.—One- (or spuriously two) celled; **a siliqua or silicula.**
SEED.—No albumen.

Example.—Sinapis; Armoracia.

CARYOPHYLLACEÆ . . . HERBS.

STEMS.—**Tumid (swollen) at nodes.**
LEAVES.—**Opposite, entire, exstipulate.**
CALYX.—Tubular.
COROLLA.—**Polypetalous,** quinquepartite, entire, or slit.
STAMENS.—**Generally ten,** occasionally four.
STYLE.—Several in number.
FRUIT.—Generally on stalk, or "carpophore;" **with free central placentation.**

Example.—Dianthus (pink).

MALVACEÆ . . . . LEAVES.—**Alternate, radiate, with stipules.**
EPICALYX.—Often present outside the *true* calyx.
CALYX.—Quadri- or quinquepartite; **inferior, persistent (valvate in bud).**
COROLLA.—**As calyx; twisted** (in bud).
STAMENS.—Numerous, **monadelphous, with one-celled reniform anthers.**
OVARY.—United or separate carpels.

Example.—Althæa; Malva (mallow).

CALYX.—Quinquepartite, one **odd anterior sepal.**

COROLLA.—Regular or irregular: if **irregular (in European plants of the order), papilionaceous** with one large posterior petal.

STAMENS.—Numerous and distinct; **or ten, in one or two bundles** (diadelphous).

OVARY.—One-celled; one- or many-seeded.

FRUIT.—**Legume, lomentum**, or rarely drupe.

Example.—Pisum (pea); Faba (bean).

ROSACEÆ . . . . . . LEAVES.—**As those of Leguminosæ.**

EPICALYX.—Often present.

CALYX.—**Quadri-** or **quinquepartite; persistent.**

STAMENS.—**Numerous, perigynous, with two-celled innate anthers.**

PISTIL.—**Distinct, superior** (rarely inferior), with one or many ovules.

DISC.—Often present.

FRUIT.—Pome, drupe, follicle, nut, achenium: in the rose there are numerous achenia attached on inside, in strawberry on *outside*, of a fleshy receptacle.

SEED.—**Exalbuminous.**

Example.—Rosa; Prunus (plum).

CUCURBITACEÆ . . . . HERBS.—**Mostly** succulent.

LEAVES.—**Rough**; alternate.

FLOWERS.—**Unisexual** (with either stamens or pistil, *not* both).

CALYX.—**Superior**; small.

COROLLA.—**Monopetalous.**

STAMENS.—(In male flower) usually five; **epipetalous, distinct or united in one or more bundles.**

PISTIL.—(In female flower).

OVARY.—**Inferior, with parietal placenta.**

STIGMA.—**Expanded.**

FRUIT.—**Succulent; generally a "pepo."**

SEEDS.—Flat.

Example.—Colocynthis; Ecbalium.

Chart.

(*a*) *The Stalk.* Occasionally wanting, generally long and cylindrical. Its junction with the anther may be—

(1) Along the back of the two lobes, causing an *adnate* anther.
(2) At the base of lobes only, causing an *innate* anther.
(3) At centre of anther, at a single point, causing a *versatile* anther.

(*b*) *The Anther.* Divided in two lobes, each generally two-celled; joined by the connective. These lobes, usually oval, are sometimes of various shapes and sizes, and in most plants of a yellow colour; they are *extrorse* (*aa*), if turned away from the pistil; *introrse* (*bb*), if with their face towards the centre of the flower. The anther, when ripe, opens usually each lobe longitudinally, and discharges the pollen.

(*c*) *Pollen.* Cells, or pollen-grains, formed in the lobes of the anther; usually separate, occasionally in masses. The pollen-grain has two coats, the *extine* and the *intine*; it is generally round or oval, and contains a granular nitrogenous matter, *fovilla.* When the pollen-grain falls on the stigma of the pistil, the extine opens, and the intine protrudes as a tube. This, proceeding down the conducting tissue of the style, reaches and impregnates the ovule.

Examples.

N. O. Ranunculaceæ (1)
N. O. Papaveraceæ (2)
N. O. Rosaceæ (3)

N. O. Liliaceæ (generally) (*bb*)
N. O. Iridaceæ (*aa*), Melanthaceæ.

In examining the stamens in their relations to each other, the following are a few of the principal terms employed:—

1. Situation.		
Hypogynous (*a*)	Arising from *below* the pistil.	
Perigynous (*b*)	Situated round the pistil, adhering to the calyx.	
Epigynous (*c*)	Growing *upon* the pistil (ovary).	
Epipetalous (*d*)	Upon the corolla.	Digitalis (*d*) (Fig. 189.)
Gynandrous (*e*)	Forming one column with the gynœcium (pistil).	The flowers of N. O. Orchidaceæ have only one column, comprising the pistil and stamens (*e*)
2. Number and union.		
Monandrous (*f*)	One stamen.	
Diandrous (*g*)	Two stamens, &c.	
Syngenesious (*h*)	Anthers only united, filaments free.	N. O. Compositæ (*h*)
Monadelphous (*i*)	Filaments united in one bundle.	Malva (*i*)
Diadelphous (*j*)	Filaments united in two bundles.	Papilionaceæ (ten stamens, nine in one bundle, one separate) (*j*)
3. Relative length.		
Tetradynamous (*k*)	Six stamens—*two* short, *four* long.	N. O. Cruciferæ (*k*)
Didynamous (*l*)	Four stamens—*two* short, *two* long.	N. O. Labiatæ, Scrophulariaceæ (Digitalis) (*l*) (Fig. 189.)

The fruit ("bladder") of the Senna (Fig. 84) clearly proves that the carpel is a modified leaf.

Atropa Belladonna . . (Fig. 192.)

Crocus sativus. The stigmata, with remains of the styles; the stigma tripartite, expanded and notched; the style narrow and capillary. (Fig. 200.)

At the summit of the poppy-capsule is the sessile stigma (*b*).

(*aa*) Digitalis . . (Fig. 189.)
(*bb*) Rosa . . . .

In the "legume" of Cassia fistula (Fig. 16) are false dissepiments, called *phragmata*.

(1) Atropa Belladonna . (Fig. 192.)
Colchicum . . . (Fig. 199.)

The specimens of fruit given later on are also specimens of ovaries, in many cases modified in the process of ripening, but still to a great degree preserving their original form.

In orange (*Aurantium*) (Fig. 79). 1, peel; 2, white layer; 3, membranous partitions; the "pulp" consists of enlarged succulent placenta.

In plum (*Prunus*). 1, skin; 2, pulp; 3, stone.

VII. The Pistil.—The female organ of reproduction.

It consists of folded carpels, one or more, distinct (apocarpous) or united (syncarpous); *simple* if of one, *compound* if of several. The carpel represents a folded modified leaf; the back is the *dorsal suture*, the face (or union of margins) the *ventral suture*. Thus, in a simple ovary, carpel and ovary are synonymous and convertible terms.

(*a*) *The Style* (or column), supporting the stigma, not always present, consisting, interiorly, of loose cellular *conducting* tissue.

(*b*) *The Stigma* (or the apex of style), generally covered with a viscid fluid, to hold the pollen-grains; a prolongation of the style; a flattened expansion of the conducting tissue.

(*c*) *The Ovary*. This contains the ovule, or future seed. It is at the base of the style; superior (*aa*) or inferior (*bb*) to the calyx.

A flower is monogynous (one carpel or style), digynous (two carpels), &c., &c.

The pistil, when *compound*, may be, as above mentioned, apocarpous (carpels distinct), or syncarpous (carpels united); the compound ovary (as opposed to the compound pistil), consisting of several ovaries (*i. e.*, several carpels) in perfect union, forming one body and one ovary. This compound ovary has, therefore, cavities, or loculi, divided by walls, or *dissepiments* (*i. e.*, margins of carpels), or, by their union, may be unilocular. At the ventral suture of each carpel is a cellular growth, called the *placenta*, to which is attached the *ovule*: (1) *axile*, or on axis, in compound many-celled ovaries; (2) *parietal*, or on walls; or (3) *free central*, on central axis, in one-celled compound ovaries.

The Ovule, or the future seed; situated, one or more, in an ovary, or occasionally naked. In ovary, either sessile on the placenta, or attached by a cord, or funiculus (*raphe*, when elongated and adhering to ovule), appearing at first as a round nucleus. It may, on development, be straight, curved, or inverted. The *micropyle* is the orifice at apex of nucleus; the *chalaza*, the connecting link with the ovary-wall; the *hilum*, point of attachment to placenta.

VIII. The Fruit.—The ovary after the fertilization of the ovale; it generally (but with exceptions) has the same structure. It is as the ovary, superior or inferior, simple and compound, apocarpous and syncarpous.

It has two parts—*α* Pericarp.
β Seeds.

Examples.	*Chart.*
In almond (*Amygdalus*). 1, skin; 2, green layer; 3, woody shell. In Colocynthis (Fig. 44), the so-called pulp is the endocarp, the epi- and mesocarp having been pared off. In Bela (Fig. 43), the three coats can be well noticed.	*a* Pericarp, or shell; with three layers { 1. Epicarp, or outer coat. 2. Mesocarp; if fleshy, sarcocarp. 3. Endocarp; if stony, putamen. The fruit opens, generally at one or both sutures of the carpels, but in various ways: where this opening, or dehiscence, does not occur, the fruit is *indehiscent.* *Dehiscence*—At sutures, or junction of carpels; this may be either— (*a*) Valvular— (1) Septicidal, down either dissepiment. (2) Loculicidal, by dorsal sutures. (3) Septifragal, by dorsal sutures, breaking away from and leaving the dissepiments.
(*b*) *Transverse* dehiscence is well shown in fruit of Hyoscyamus; (*c*) *porous* in capsule of Papaver (Fig. 191.) (*a*) Valvular in Aconitum (Fig. 188.)	*b* Transverse—By a transverse line, the top coming off like a lid. *c* Porous—By holes or pores in the fruit.
	There are many varieties of fruit: we will name a few of the most important ones, following here the arrangement of Professor Bentley. For the important study of the various sorts, a full description is necessary: this can be found only in a complete Manual of Botany. A. Fruits from one flower. B. Fruits from numerous flowers combined. A. *Fruit from one Flower*— I. Simple fruit. II. Apocarpous fruit. III. Syncarpous fruit.
1. N. O. Leguminosæ. (*a*) 2. Cassia fistula . . . (Fig. 16.) 3. Peach . . . . Oliva, Prunus	I. *Simple Fruit.*—A single carpel in a single flower. 1. Legume, or pod *Two*-valved, various shaped (*a*). 2. Lomentum . Legume contracted at points. 3. Drupe . . Stone-fruit. Fleshy, indehiscent. 4. Utricle . One-celled, with membranous pericarp.
5. Aconitum (Fig. 188); Helleborus .	II. *Apocarpous Fruit*—Several carpels, *distinct,* in a single flower. 5. Follicle . Superior, one-celled, one or many seeded, one-valved. Several produced by one flower.

6. N. O. Labiatæ		6. Achenium .	One-celled, one-seeded, with dry indehiscent pericarp.
		7. Etærio .	A collection of achenia in zone, as in Strawberry.

III. *Syncarpous Fruit.*

8. N. O. Graminaceæ	Superior	8. Caryopsis .	One-celled, one-seeded, indehiscent; pericarp united with seed.
9. Datura Stramonium (Fig. 193.) Papaver (globose, obovate, papyraceous, with remains of the star-like stigma), Cardamomum . (Fig. 70.) Hyoscyamus niger . (Fig. 191.)		9. Capsule .	One-, or more, celled, many-seeded, dry, dehiscent.
10, 11. Many of N. O. Cruciferæ . .		10. Siliqua .	Long, narrow, dehiscing in a valvular manner, &c.
		11. Silicula .	As siliqua, but short and broad.
12. Aurantium		12. Hesperidium	Many-celled, indehiscent.
13. Peculiar to N. O. Umbelliferæ, *ex. gr.*, Conium . (Figs. 196 & 128.) Fœniculum . (Fig. 124.) Coriandrum . (Fig. 125.) Carum . (Fig. 126.) Anethum . (Fig. 127.)	Inferior	13. Cremocarp .	Dry, indehiscent, two-celled, two-seeded, on "carpophore" or axis.
14. Acorn		14. Glans, or nut	Hard, dry, one-celled, with the three layers of pericarp firmly coherent; often surrounded with capsule.
15. Piper nigrum . . . (Fig. 72.) Capsicum . . . (Fig. 85.) Solanum Dulcamara (Fig. 194.) Atropa Belladonna (Fig. 192.)		15. Bacca .	Berry; indehiscent, many-seeded, pulpy.
16. Ecbalium (the fruit of the "Squirting Cucumber," which gives Elaterium) Colocynthis (thin rind, globose, large) . . . . (Fig. 44.)		16. Pepo . .	One (or spuriously three) celled, many-seeded, pulpy or fleshy.
17. Apple, Cydonia		17. Pome . .	Indehiscent, two or more scaly carpels, covered by fleshy mass.

B. *Fruit from several Flowers combined.*

18. Fir, Pine (N. O. Coniferæ) . .	18. Cone . .	Collective head, generally conical, of numerous hard membranous bracts, covering *naked seeds.*
19. Cupressus . . . (Fig. 198.) Juniperus Sabina . (Fig. 197).	19. Galbulus .	Small rounded cone, with succulent enlarged scales.

Examples.	*Chart*	
20. Lupulus. Membranous, persistent bracts (scales), having at their base small hard achenia, covered with round aromatic glands of *Lupuline* .	20. Strobile .	Membranous cone, but with seeds enclosed in *ovaries.*
21. Pine-apple, Morus.	21. Sorosis .	Fleshy mass, on thalamus (or receptacle).
22. Ficus	22. Syconas .	Enlarged succulent receptacle, bearing numerous flowers and ovaries with ovules.

IX. **The Seed.**—The ovule, enclosed in the ovary (or sometimes naked), on being fertilized by the fovilla of the pollen, becomes the seed.

The Seed is the ovule after fertilization: similar to it in internal structure, but externally differing much, as regards shape, size, colour, &c.

We will consider—I. Coats.
II. Nucleus.

I. *Coats of Seeds.*

Two in number
- 1. *Testa* (*a*), outer, thickened coat, soft, woody, fleshy, hairy (*b*), &c.
- 2. *Endopleura* (*c*), inner coat, thin and delicate (*bb*).

The Arillus is a false coat, occasionally seen, *ex. gr.*, Mace, covering the nutmeg (*aa*).

II. *Nucleus* .
- 1. Albumen (*d*), often absent, surrounding the embryo.
  - Of various natures . .
    - horny, in Nux vomica (*e*).
    - starchy, in wheat (Triticum).
    - oily, in Ricinus.
    - ruminated (mottled), in nutmeg, (*n*).
- 2. Embryo (*m*) or rudimentary plant
  - *radicle*, or root, growing downwards (*f*).
  - *plumule*, or stem, growing upwards (*g*).
  - *cotyledons*, one or two; one or two fleshy (*h*) nursing leaves, lobes.

The seed, as the ovule, may possess a raphe (*i*), chalaza (*k*), and hilum (*l*).

"Myristica" (Fig. 24), which is the seed itself removed from the "arillode" (*aa*) and shell, or "fruit," consists of oily albumen, marbled, with the endopleura (*bb*) dipping down into it.

Nux vomica (Fig. 29) is a good example of a seed. In the centre of concave side is an elevated point, the hilum (*l*); from this point a slight ridge, the raphe (*i*), runs to a slight prominence at the circumference, the chalaza (*k*). It has two coats, a fibrous ash-grey testa (*a*) with silky hairs (*b*); thin endopleura (*c*). The nucleus, on cutting the seed open, consists of bipartite albumen (*d*), horny (*e*), with an embryo (*m*), having a radicle (*f*), plumule (*g*), and two large, thin, heart-shaped cotyledons (*h*)

Myristica (Fig. 24.)
Areca Catechu (Fig. 23.)
} Examples of ruminated albumen (*n*).

Gran. Parad. (Guinea pepper). (Fig. 59.)

INTERNAL STRUCTURE.

All vegetable tissue is built up of the cell, modified or altered by circumstances. The typical cell is spherical; an elongated and strengthened modification is the vessel.

The *disc-bearing* cells in the woody tissue of the Coniferæ are, in medical jurisprudence, considered a strong proof of presence of "sabina" (*aa*).

The removal and subsequent addition of chlorophyll is an important point in the preparation of "green" extracts (*bb*).

The presence of "raphides" gives the grittiness observed in China rhubarb, and *not* in European (*cc*).

Liber, or inner bark; the general hard "wood" of trees.

Assafœtida, and the other oleo-gum-resins of the Umbelliferæ, exist as latex, in a state termed "emulsive."

(*α*) The scales on the rhizome of Filix-mas; the hairs ("pubes") on the Dolichos pod . . . . . . }

(*β*) Lupuline, glands of "hop"; the receptacles of volatile oil in rind of orange, lemon, &c. . . . }

A. Cell as individual.

Form—Spherical, elongated, stellate, polygonal.

Structure—Transparent, formed of cellulose; bands of secondary deposit give pitted, spiral, fibrous cells (*aa*).

Contents—Protoplasm (viscid, nitrogenous).
Primordial utricle, nucleus (cytoblast).
Sap (watery liquid).
Chlorophyll (green granules) (*bb*).
Sugar, raphides (crystals) (*cc*).
Starch (often in abundance).

B. Cell as connected.

1. *Cellular Tissue*—Either the connexion is complete or incomplete: in the former, the cells touch on every side (regular, elongated, or tabular); in the latter, at points only (round or spherical, spongiform or stellate).
2. *Woody Tissue*—Overlapping, lengthened, tapering, thickened (by concentric layers), cellular tissue.
3. *Vascular Tissue*—Formed of vessels, which are long cells or several cells whose divisions have been absorbed; often large, with thickened sides, pitted, spiral, annular, scalariform, &c. Laticiferous tissue is reticulated, and contains latex (watery fluid), becoming milky on exposure to air.
4. *Epidermal Tissue*—Consists of epidermis (tabular cellular tissue), cuticle (thin membrane), with stomata, which are ovate breathing pores on green exposed surfaces.

5 (*α*) *Hairs*—Cell or cells enlarged or lengthened; as hairs, scales, bristles, prickles.

(*β*) *Glands*—Secreting cells, external or internal.

6. *Cell-growth*—Either by cell-formation (free in parent cell, with or without nucleus) or by multiplication of cells by cell-division, without absorption of parent-cells (as in the formation of some vessels from cells), or with absorption of parent-cell and the freedom of the new cells.

PART II.—**Classification.**

There have been, at successive stages in the history of the science of Botany, several different systems in the arrangement of plants. The Linnæan was an artificial classification, from the number of stamens and pistils; the *natural* system, introduced by Jussieu, improved by De Candolle, and further amended by Lindley, is, with modifications, the one in general use at the present day. Its essential principle consists in the grouping of plants according to their general structure and evident resemblance in organs and properties. The arrangement adopted in this work is that given by Professor Bentley, which seems the most satisfactory yet published.

In this classification, individual plants are arranged in *orders*, most justly called *natural;* these orders are subdivided into ***genera*** and ***species***.

SPECIES consist of individuals resembling each other in every respect, reproducing the same essential character by seed. (Atropa) *Belladonna.*

GENERA.—Several species, much resembling each other in organs of reproduction. *Atropa.*

NATURAL ORDER.—Genera that have the same fruit, or some marked features or properties in common. N. O. *Umbelliferæ, Graminaceæ.*

CLASS.—Natural orders that have the same *internal structure, ex. gr.*, Dicotyledonæ.

SUB-CLASS.—A division, for convenience, in a class.

Class.	*Division.*		*Sub-Class.*
I. DICOTYLEDONÆ	1. Angiospermæ (ovules in ovary)	(α) Thalamifloræ	Stamens hypogynous.
		(β) Calicyfloræ	Stamens perigynous or epigynous.
		(γ) Corollifloræ	Corolla monopetalous; stamens on corolla or ovary, or free and arising from thalamus.
		(δ) Monoclamydeæ	One floral envelope only.
	2. Gymnospermæ (ovules naked).		
II. MONOCOTYLEDONÆ		(ε) Dictyogenæ.	
		(ζ) Petaloideæ	With coloured floral envelopes.
		(η) Glumaceæ	As grasses.
III. ACOTYLEDONÆ		(θ) Acrogenæ	With stems.
		(ι) Thallogenæ	With flattened expansion, or *thallus.*

NATURAL ORDERS.

The following are the essential features of the principal Natural Orders which embrace the plants mentioned in the Pharmacopœia: the officinal plants are mentioned under each natural order in the Section of Materia Medica. (*The characteristic features peculiar to the order are in heavy Egyptian type*). For the signification of terms, see Division on "Structural Botany."

RANUNCULACEÆ . Leaves.—Alternate or opposite, generally much divided.
Petioles.—Sheathing and dilated.
Stipules.—**None distinct from petiole.**
Corolla.—**Imbricated** (the folding of the petals in flower-bud).
Stamens.—**Hypogynous.**
Anthers.—**Adnate.**
Fruit.—**Apocarpous ;** follicles or achenia (carpels distinct).
Seed.—*Albumen*, **Horny.**
Sap.—Watery.
Example.—Ranunculus; Helleborus (Fig. 187); Aconitum (Fig. 188).

NYMPHACEÆ . . . . . . Plants.—**Aquatic.**
Leaves.—Floating, circular, peltate.
Calyx and Corolla.—Passing, by degrees, into stamens and pistil, some of which are often petalloid.
Disc.—Encircling ovary.
Stigma.—**Sessile, radiating.**
Fruit.—**Of the united carpels, superior, many-celled,** with **seeds attached** to **perfect dissepiments.**
Seed.—With mealy albumen.
Example.—Nymphæa (water-lily).

(The characters in N. O. Nelumbiaceæ are similar to above, but the fruit are **numerous two-celled "nuts," in the cells of a honeycombed thalamus,** or receptacle.)

PAPAVERACEÆ . . . . . Leaves.—Alternate, exstipulate.
Calyx.—**Two**, or rarely three, sepals ; **deciduous** (falling off on the expansion of the corolla).
Corolla.—Four petals, generally plicate (in folded flower-bud).
Stamens.—**Numerous innate anthers.**
Stigma.—Two or numerous, radiating, often sessile.
Fruit.—**One-celled compound capsule, with many seeds on parietal placentæ.**
Seeds.—Numerous, **with oily albumen.**
Sap.—**Milky.**
Example.—Papaver (poppy).

SECT. II.—**Botany**—*continued.*

CRUCIFERÆ . . . . PLANTS.—Herbs.

LEAVES.—**Alternate, exstipulate.**
CALYX.—**Four sepals.**
COROLLA.—**Four petals, in a cruciform manner.**
STAMENS.—**Six, tetradynamous, four long and two short.**
STIGMA.—Two stigmata.
FRUIT.—One- (or spuriously two) celled; **a siliqua or silicula.**
SEED.—No albumen.

Example.—Sinapis; Armoracia.

CARYOPHYLLACEÆ . . . HERBS.

STEMS.—**Tumid (swollen) at nodes.**
LEAVES.—**Opposite, entire, exstipulate.**
CALYX.—Tubular.
COROLLA.—**Polypetalous,** quinquepartite, entire, or slit.
STAMENS.—**Generally ten,** occasionally four.
STYLE.—Several in number.
FRUIT.—Generally on stalk, or "carpophore;" **with free central placentation.**

Example.—Dianthus (pink).

MALVACEÆ . . . . . . LEAVES.—**Alternate, radiate, with stipules.**
EPICALYX.—Often present outside the *true* calyx.
CALYX.—Quadri- or quinquepartite; **inferior, persistent (valvate in bud).**
COROLLA.—**As calyx; twisted (in bud).**
STAMENS.—Numerous, **monadelphous, with one-celled reniform anthers.**
OVARY.—United or separate carpels.

Example.—Althæa; Malva (mallow).

CALYX.—Quinquepartite, one **odd anterior sepal.**

COROLLA.—Regular or irregular: if **irregular (in European plants of the order), papilionaceous** with one large posterior petal.

STAMENS.—Numerous and distinct; **or ten, in one or two bundles** (diadelphous).

OVARY.—One-celled; one- or many-seeded.

FRUIT.—**Legume, lomentum,** or rarely drupe.

Example.—Pisum (pea); Faba (bean).

ROSACEÆ . . . . . . LEAVES.—**As those of Leguminosæ.**

EPICALYX.—Often present.

CALYX.—**Quadri-** or quinquepartite; **persistent.**

STAMENS.—**Numerous, perigynous, with two-celled innate anthers.**

PISTIL.—**Distinct, superior** (rarely inferior), with one or many ovules.

DISC.—Often present.

FRUIT.—Pome, drupe, follicle, nut, achenium: in the rose there are numerous achenia attached on inside, in strawberry on *outside*, of a fleshy receptacle.

SEED.—**Exalbuminous.**

Example.—Rosa; Prunus (plum).

CUCURBITACEÆ . . . . HERBS.—**Mostly** succulent.

LEAVES.—**Rough**; alternate.

FLOWERS.—**Unisexual** (with either stamens or pistil, *not* both).

CALYX.—**Superior**; small.

COROLLA.—**Monopetalous.**

STAMENS.—(In male flower) usually five; **epipetalous, distinct or united in one or more bundles.**

PISTIL.—(In female flower).

OVARY.—**Inferior, with parietal placenta.**

STIGMA.—**Expanded.**

FRUIT.—**Succulent; generally a "pepo."**

SEEDS.—Flat.

Example.—Colocynthis; Ecbalium.

ONAGRACEÆ . . . Leaves.—**Alternate or opposite; exstipulate.** (Not dotted, as the leaves in N. O. Hypericaceæ.)

Calyx.—Superior, two- to four-lobed, monosepalous; valvate } Æstivation, as N.O. Malvacæa.
Corolla.—As calyx; . . . . twisted }

Stamens.—Two to eight; **pollen trigonal (three-cornered), attached by funiculi** (cords).

Stigma.—Generally capitular.

Ovary.—One- to four-celled; **inferior.**

Through this order reigns **the power of two:** $\sqrt[2]{}$

Example.—Fuchsia.

UMBELLIFERÆ . . Herbs.—In temperate climates.

Stems.—Hollow (often); knotted (or tumid) at joints.

Leaves.—Alternate, embracing, much divided.

Inflorescence.—**An umbel.**

Calyx.—Superior, five-toothed; little or no limb.

Corolla.—**Five petals, with incurved points.**

Disc.—Superior.

Stamens.—**Five; incurved; alternate.**

Styles.—Two.

Fruit.—**A cremocarp; two divisions, with vittæ, or oil-cells;** dry, indehiscent.

Example.—Conium maculatum (hemlock) (Fig. 196); Æthusa (Fig. 195).

CAPRIFOLIACEÆ . Leaves.—Opposite, **exstipulate**

Calyx.—Superior.

Corolla.—Four- or five-cleft; monopelatous, generally rotate.

Stamens.—**Four or five; equal in number to and alternate with petals.**

Ovary.—Inferior.

Seeds.—Solitary; **fleshy albumen.**

Example.—Sambucus nigra (elder).

GALIACEÆ . . . . . .

Stems.—**Angular.**
Leaves.—**Whorled, exstipulate.**
Calyx.—Superior, obsolete (scarcely visible); four- to six-lobed.
Corolla.—Regular.
Stamens.—Four to six; epipetalous.
Ovary and Fruit.—Two-celled, two-seeded ("double fruit").

CINCHONACEÆ . . . .

Characters as above, but with stems **round**; leaves, with **interpetiolate stipules.**
Example.—Cinchona.

VALERIANACEÆ . . .

Inflorescence.—Head or capitulum, **with general involucre, but not individual involucre.**
Calyx.—Membranous or pappous (feathery); superior.
Corolla.—Three- to six-lobed; regular or generally irregular; sometimes spurred.
Stamens.—One to five; *not* equal to lobes of corolla; anthers **separate.**
Fruit.—Dry, indehiscent.
Seeds.—**Exalbuminous.**
Example.—Valeriana.

DIPSACACEÆ . . .

Inflorescence.—Capitulum or head.
Leaves.—Opposite or whorled, exstipulate.
Calyx.—Perfect, present.
Corolla.—**Four or five; lobed; irregular or tubular.**
Stamens.—Four; **distinct anthers.**
Style.—**Not divided.**
Fruit.—
Seeds.—**Fleshy albumen.**
Example.—

COMPOSITÆ . . . . . HERBS OR SHRUBS.

LEAVES.—**Alternate or opposite, exstipulate;** often compound.

INFLORESCENCE.—**Capitulum, with general involucre, and often paleæ** (scales between flor

CALYX.—**Obsolete (absent); or pappous or membranous.**

COROLLA.—**Monopetalous, irregular or regular**—of the disc (centre) often tubular; of the ray (outer circle) often ligulate or strap-shaped; occasionally labiate.

STAMENS.—**Four or five; alternate with lobes of corolla; anthers syngenesious or united, enclosing, as with a tube, the style.**

OVARY.—**One-celled, one-seeded.**

FRUIT.—**Dry, indehiscent.**

SEEDS.—Solitary; **exalbuminous.**

Example.—Anthemis nobilis.

CAMPANULACEÆ . . . . LEAVES.—Alternate, exstipulate.

INFLORESCENCE.—Occasionally in a capitulum; often solitary.

CALYX.—Superior, leafy, persistent.

COROLLA.—**Regular,** valvate; often marcescent (remaining when withered and shrivelled).

STAMENS.—Four or five; **not united.**

STYLE.—Simple.

FRUIT.—**Capsule;** two-, or more, celled; **axile placenta.**

SEEDS.—Numerous.

SAP.—Milky.

Example.—Campanula.

LOBELIACEÆ . . . . . As above, but with **corolla irregular.**

ANTHERS.—**Syngenesious.**

Example.—Lobelia.

[illegible] . . . . . Leaves.—Exstipulate.

Calyx and Corolla.—Regular, persistent.

Stamens.—**Equal to and alternate with lobes of corolla.**

Ovary.—**One-celled** (or **spuriously two-celled**). **Two parietal placentæ.**

Seeds.—Fleshy albumen.

Example.—Gentiana lutea.

CONVOLVULACEÆ . . . . Herbs.—**Weak, twining or trailing.**

Leaves.—**Entire, alternate, exstipulate.**

Calyx.—Persistent, quinquepartite, **plaited** (in bud).

Disc.—Hypogynous.

Stamens.—Five; alternate with lobes of corolla.

Ovary.—Simple.

Fruit.—Capsule; few-seeded.

Example.—Convolvulus Scammonia.

SOLANACEÆ . . . . . Leaves.—Alternate.

Inflorescence.—**Generally extra-axillary** (or *not* in the axil of a leaf or bract).

Calyx.—Four or five; regular.

Corolla.—Four or five; **valvate or induplicate** æstivation (or folding in flower-bud).

Stamens.—Five, **alternate; anthers introrse, with longitudinal or porous dehiscence.**

Ovary.—**Two-celled.**

Fruit.—**A bacca or capsule.**

Example.—Hyoscyamus niger (Fig. 191); Solanum Dulcamara (Fig. 194).

ATROPACEÆ . . . . . . Characters as above, but corolla **imbricated** (in bud).

Stamens.—**Five, with one or two sterile.**

Example.—Atropa Belladonna (Fig. 192).

OLEACEÆ . . . . . .

Leaves.—Opposite, exstipulate.
Calyx.—Four-cleft, inferior, persistent.
Corolla.—**Regular, valvate** (in bud).
Stamens.—**Two.**
Ovary.—Two-celled, two-seeded.
Fruit.—Drupe, bacca, capsule.
Seeds.—**Fleshy albumen.**

Example.—Olea.

BORAGINACEÆ . . . . .

Plants.—Herbs or shrubs.
Stems.—**Round, rough.**
Leaves.—**Alternate, rough.**
Inflorescence.—**A scorpioid cyme.**
Calyx.—Inferior.
Corolla.—**Regular,** five-lobed.
Style.—Simple.
Ovary.—Superior, four-lobed.
Fruit.—**Four achenia.**

Example.—Borago; Anchusa.

RIMULACEÆ

Herbs.
Leaves.—**Simple,** exstipulate.
Calyx and Corolla.—Four- or five-cleft, persistent; calyx **imbricated** (in bud).
Stamens.—**Equal in number to, and opposite to lobes of corolla.**
Stigma.—Capitate.
Ovary.—**One-celled, with free central placenta.**
Fruit.—**Capsule; dehiscent, transverse or valvular.**
Seeds.—**Albuminous.**

Example.—Primula (primrose).

LABIATÆ . . . . HERBS OR SHRUBS.

STEMS.—**Square.**
LEAVES.—**Opposite, exstipulate.**
CALYX.—**Persistent.**
COROLLA.—Irregular; bilabiate (lipped).
STAMENS.—**Didynamous** (two long, two short).
PISTIL.—Style, basilar; stigma, **forked.**
OVARY.—**Deeply four-lobed.**
FRUIT.—One to four achenia; much volatile oil.
Example.—Lavandula vera; Mentha.

SCROPHULARIACEÆ . . . HERBS; rarely shrubs.

LEAVES.—Alternate or opposite, exstipulate.
CALYX.—**Irregular, persistent.**
COROLLA.—Four or five; **irregular.**
STAMENS.—**Two, four, or five, not corresponding with the number or position of the lobes of the corolla; if four, didynamous.**
OVARY.—**Two-celled.**
FRUIT.—Capsule; two-celled, many-seeded, superior.
Example.—Digitalis purpurea (this has four didynamous stamens) (Fig. 189); Verbascum Thapsus (Fig. 190).

POLYGONACEÆ . . LEAVES.—Generally alternate; **stipules ochreate** (or forming a sheath round the stem).

CALYX.—Free, polysepalons, **persistent.**
FLOWERS.—**Unisexual** generally.
STAMENS.—Perigynous or hypogynous.
OVARY.—One-celled, one-seeded.
STYLES AND STIGMATA.—Numerous.
FRUIT.—**Triangular nut, with remains of stigmata.**
SEED.—Fleshy albumen.
Example.—Rumex; Rheum palmatum.

EUPHORBIACEÆ . . . .

FLOWERS.—Unisexual, either monœcious (staminate and pistillate flowers on *one plant*) or diœcious (on two different plants).

CALYX.—Inferior or absent.

COROLLA.—Absent in these *monochlamydeous* plants.

STAMENS.—In male flower, one or more, either distinct or in one or more bundles (as Ricinus).

PISTIL.—In female flowers, one or more carpels.

FRUIT.—Coccus, one or more; one or more dry carpels, separating, elastic, discharging the seed. (In Euphorbium, *tricoccous.*)

SEEDS.—Fleshy albumen.

SAP.—Milky, acrid, irritant.

Example.—Ricinus communis.

CLASS II.—MONOCOTYLEDONÆ.

ORCHIDACEÆ . . . . .

HERBS; sometimes parasites or epiphytes.

ROOTS.—Tuberous or fibrous.

STEMS.—Often so swelled as to be termed *pseudo-bulbs.*

LEAVES.—Entire; often sheathing.

PERIANTH (or petalloid Calyx and Corolla, consisting of *six* apparent petals).—Irregular, the three inner petals larger, and one (the labellum) of unusual shape.

STAMENS.—Gynandrous, forming *one* column with the pistil.

OVARY.—One-celled.

STIGMA.—Viscid spot in front of the gynandrous column.

FRUIT.—A twisted capsule, one-celled, many-seeded; parietal placentæ.

Example.—Orchis.

IRIDACEÆ . . . .

ROOT.—The so-called root is generally a rhizome (or underground stem), giving out *true* rootlets.
LEAVES.—Equitant (overlapping and sheathing each other in an angular manner).
PERIANTH.—**Superior; regular or irregular, with three short petals, shorter than the others.**
STAMENS.—**Three; extrorse anthers.**
OVARY.—**Inferior,** three-celled.
STIGMATA.—**Three.**
FRUIT.—Capsule, tripartite; axile placenta, loculicidal dehiscence.

Example.—Iris; Crocus sativus (Fig. 200).

AMARYLLIDACEÆ . . . .

BRACTS.—Spathes (enveloping the flower-axis).
PERIANTH.—**Superior**; sometimes with a "corona" on interior.
STAMENS.—**Six; introrse anthers.**
STYLE.—Simple.
OVARY.—**Inferior,** three-celled.
FRUIT.—**Capsule; three-celled, three-valved, loculicidal.**
SEEDS.—**Albuminous.**

Example.—Agave (American aloe).

LILIACEÆ . . . . .

ROOTS.—Various, often bulbs or corms (in reality, *stems*).
LEAVES.—Generally sheathing.
PERIANTH.—**Inferior.**
STAMENS.—**Six; introrse**; often with **versatile anthers.**
STYLE.—Simple.
OVARY.—Three-celled; axile placenta; **superior.**
FRUIT.—A capsule, **with loculicidal dehiscence,** three-celled; **succulent, indehiscent, with** numerous seeds.
SEEDS.—**Fleshy albumen.**

Example.—Aloë; Allium (onion).

MELANTHACEÆ, or COLCHICACEÆ. Much resembles N. O. Liliaceæ.

PERIANTH.—**Inferior**; white, green, or purple.
STAMENS.—**Six; extrorse anthers.**
STYLE.—**Tripartite.**
OVARY.—**Superior**, three-celled.
FRUIT.—Three-celled, with septicidal dehiscence (generally).
SEEDS.—Fleshy albumen.

Example.—Veratrum viride; Colchicum (Fig. 199).

(**N.B.**—In the four latter orders, note **number** of **stamens and position** of ovary.)

PRINCIPAL NATURAL ORDERS COMPARED.

Natural Order.	*Floral Envelopes.*	*Stamens.*	*Placenta.*	*Calyx.*	*Leaves.*
SOLANACEÆ	Regular	Epipetalous; alternate with lobe of corolla.	Central		Not ribbed.
SCROPHULARIACEÆ	Irregular.				
ERICACEÆ		Hypogynous.			
GENTIANACEÆ		Alternate with lobe of corolla	Parietal.		
PRIMULACEÆ		Opposite lobes of corolla		Imbricated	Ribbed.
CONVOLVULACEÆ				Plaited.	

Natural Order.	*Stem.*	*Leaves.*	*Inflorescence.*	*Floral Envelopes.*	*Stamens.*	*Ovary.*
LABIATÆ	Square, angular	Opposite; exstipulate		Irregular	Didynamous	Four-celled.
SCROPHULARIACEÆ		Opposite or alternate leaves; exstipulate.		Valvate; irregular	Two, four, or five	Two-celled.
SOLANACEÆ					Five; fertile.	
ATROPACEÆ				Imbricated; irregular	If five, one or two sterile.	Two-celled.
BORAGINACEÆ	Round, rough	Exstipulate, alternate	Scorpioid cyme	Regular	Five	Four-celled.

Natural Order.	*Sap.*	*Stipules.*	*Calyx.*	*Stamens.*	*Carpels (fruit).*	*Placenta.*	*Albumen.*
RANUNCULACEÆ	Watery	None	Three to six; deciduous	Numerous; hypogynous	Apocarpous		Horny.
PAPAVERACEÆ	Milky		Two sepals; caducous (before petals open).	Numerous	Syncarpous	Parietal, on spurious dissepiments.	Oily.
ROSACEÆ			Persistent	Numerous; perigynous			
NYMPHACEÆ			Persistent	Numerous	Syncarpous	Perfect dissepiments.	
CISTACEÆ			Persistent	Numerous		Parietal.	
CRUCIFERÆ				Six; tetradynamous			None.
MAGNOLIACEÆ		Stipules present.					

Natural Order.	*Leaves.*		*Inflorescence.*	*Floral Envelopes.*	*Stamens.*	*Seed.*	*Fruit.*
COMPOSITÆ	Opposite; alternate.	Exstipulate.	Involucre; dense capitulum	Regular and irregular.	With syngenesious anthers	Exalbuminous	One-seeded.
CALYCANTHACEÆ	Alternate		No involucre		With monadelphous filaments, and only *partially* united anthers.	Albuminous	
DIPSACACEÆ	Opposite; whorled		Partial involucre to each flower.		Anthers distinct	Horny or fleshy albumen.	
VALERIANACEÆ	Opposite		No involucre	Irregular	Anthers distinct; unequal, and not alternating with petals.	Exalbuminous	
CAMPANULACEÆ				Regular	Anthers distinct		Capsular; many-seeded.
LOBELIACEÆ				Irregular	Anthers syngenesious		
CAPRIFOLIACEÆ	Opposite, exstipulate			Regular and irregular.	Equal to and alternating with petals.	Fleshy albumen.	
CINCHONACEÆ	Interpetiolar stipules			Regular.			

SECT. II.—**Botany**—*continued.*

Natural Order.	*Stamens.*	*Anthers.*
MALVACEÆ	Monadelphous	One-celled, reniform, with transverse dehiscence.
BYTTNERIACEÆ		Two-celled, introrse.
STERCULIACEÆ		Two-celled, extrorse.

Natural Order.	*Stems.*	*Leaf.*	*Inflorescence.*	*Seed.*
GRAMINACEÆ	Round, hollow, knotty	Split sheath	Ligule and paleæ	**Embryo outside albumen.**
CYPERACEÆ	Angular, solid	**Entire sheath**	None	**Embryo inside albumen.**

Natural Order.	*Perianth.*	*Stamens.*	*Anthers.*	*Style.*	*Ovary.*	*Seed (Albumen).*	*Dehiscence.*
LILIACEÆ	Inferior	Six	Introrse	Simple	Superior	Fleshy	Loculicidal.
IRIDACEÆ	Superior	Three	Extrorse	Tripartite, often petalloid.	Inferior	Horny	
AMARYLLIDACEÆ	Superior	Six	. . . .	Simple	Inferior	Horny	
MELANTHACEÆ	Inferior	Six	Extrorse	Tripartite	Superior	Fleshy	Septicidal (generally).

PART III.—**Physiology.**

The consideration of the plant in a state of life, and the study of vital force in the vegetable kingdom, are comprised under Physiological Botany.

Physiology, therefore, treats of the functions of organic tissues and of the built-up structures forming the several organs of the plant.

This presupposes the existence of "vital force." It is doubtful if in the present state of science, the hypothesis that vital force is but the exhibition in so-called *organic* structures of that force possessed *per se* by all matter, can be logically maintained as a certain and well established fact. Yet it seems according to reason to regard vital force, not as a principle in itself, overruling the physical laws of matter, and absent in those inorganic constituents when alone, which when together form organic life, but rather as the sum or result of the innate forces possessed by this aggregated matter; as the expression of collective molecular force. For as the division of living organisms into kingdoms, vegetable and animal, is but artificial, the one blending with the other, and the whole forming one long-drawn-out chain, the highest link of which is the human form, and the lowest link, of vegetable life, remaining yet to be discovered, so are the divisions of matter into organic and inorganic daily becoming more vague and less strictly determined. The identical atoms of the same elements may one day exist as an organic structure, the next day may constitute a formation classed in the inorganic or mineral kingdom. Not only is the number of organic cell-products built up from inorganic groupings now daily increasing by the onward march of chemistry, but even the artificial barriers between these two divisions of organized matter are rapidly becoming less positive and less definite. That organic structures, as opposed to inorganic formations, are dissipated by heat, or decomposed by a so-called putrefactive process, we may consider arises simply from the extreme readiness with which the atoms of their constituent elements assume the gaseous form; yet at the same time it is undeniable that the organic is a grouping of atoms of a much higher order, and of a far more complex nature, than the inorganic structure. The line of demarcation, or point of union between these two great divisions, is still to be determined: we cannot, however, expect that the old mythological fable will ever become a scientific reality, that a second Prometheus will in ages to come ever endow with life a structure of his own formation; this is at present, and apparently will remain, a secret hidden from science: for the present, therefore, we will assume the presence of "vital force," and in these few words on Physiology we will consider the effect of this force in the functions and operations of the several organs of the plant.

1. *Functions of the Plant.*—The organs of the plant, in action, display several distinct functions of vegetation. These may be classified as follows:—

1. Absorption.	3. Respiration.	5. Development.
2. Circulation.	4. Assimilation.	6. Secretion.

The first two of these functions are well described by their names. The food is taken up by *absorption*, and is transmitted by *circulation* through the individual: circulation also comprises the various movements of cell-contents throughout the different tissues. In the leaf and other green parts of the plant a peculiar process is found to take place: this is the elaboration of the crude sap, which depends entirely on the perfect operation of the functions of *respiration* and *assimilation*. By *respiration* proper oxygen is given off and carbon (of the carbonic dioxide of the air) is fixed; by transpiration water is given off, and thickening of the sap is thus necessarily produced. *Assimilation*, to which light and heat are necessary, is the formation of organic products and secretions from the inorganic constituents of the crude sap. In its subsequent descent from the leaf, the formation by this elaborated sap of new tissue is termed *development;* the production and storing-up, when these juices are in their most perfect condition, of substances peculiar to the individual plant give the function of *secretion.*

2. *Elementary Structure.*—The cellular tissue, formed and increased by the several processes of cell-formation, and afterwards thickened or altered in shape or length, absorbs and transmits the nutriment of the plant by *endosmose* (a passage of fluid inwards through the cell-membrane). In a young state the cells *elaborate*, when old they *secrete* the juice; the woody tissues give strength; the laticiferous vessels act as reservoirs, the vessels transmit air, and in spring sap; the epidermal tissues protect, absorb, and in turn prevent too great absorption; the hairs afford protection; the glands and intercellular system act as stores for the special secretions of the plant.

3 *The Organs of Nutrition.*

(*a*) The root fixes the plant, absorbs food (in liquid form only), and stores up nourishment for the plant's future existence.

(*b*) The stem serves as axis, conducts to leaves, stores up secretion, &c.; the pith feeds the young plant; the wood conveys fluid, gives strength, and receives secretions; the medullary rays convey air and act as a communication for the elaborated sap between the cambium layer and the pith; the bark protects and also conveys the sap, after the process of assimilation, downwards from the leaves to the root.

(*c*) The leaf absorbs and exhales water and air, and by these media food; it especially assimilates (manufactures) the crude sap. Exhalation (from all the green parts of the plant) depends on heat and light (illuminating rays); absorption takes place immediately below the epidermis.

In the green parts of the plant carbonic acid is absorbed, carbon is fixed, and oxygen given off.

Assimilation is the formation of secretions (as alkaloids) or products (sugar) in the tissues. Air and light are necessary for this process; in the dark, no chlorophyll (green colouring matter) is secreted; this chlorophyll frequently, by the absorption of more oxygen, changes in colour from green to yellow and red. The effect of poisonous gases is irritant and poisonous to these parts, and through them to the plant itself.

Defoliation, or fall of leaf, arises from several causes:—

1. Choking up of tissues, in leaf or petiole.
2. Growth of stem, which thus pushes off the leaf.
3. Gradual breaking-off of the union (solution of continuity) along the articula or joints. This disintegrating process advances inwards, on inside of articulation.

4. *Organs of Reproduction.*

1. *Bracts and Floral Envelopes.*—These organs protect the essential organs; if green, they act as leaves; if coloured, they absorb oxygen and give off heat, produce sugar from starch (in a similar way to coloured and succulent fruit), &c., &c.
2. *The Sexual Organs.*—Essentially to *reproduce* the plant. The pollen, from the stamens, falling on the stigma, discharges the fertilizing fovilla, generally by means of a pollen-tube, which extends the length of the style, into the ovule.

The embryo sac contains protoplasm, from which are formed the germinating vesicles.

The Fruit, or mature Ovary, is ripened by the process the most exhaustive of nutriment in the vegetable world: it is the highest act in vegetable economy.

The Seed, or mature Ovule.—The seed is the ultimate result of the life of the plant; it contains not only the existence of the future individual, but, as the "microcosm" of the vegetable world, in its most perfect state, it contains the essentials of its future being—a rudimentary root, stem, and leaves. But this "vitality," or power of reproducing the parent individual, in all its parts and characters, is capable of being destroyed. Seeds with horny albumen, however, possess much greater vitality, and are less liable to decay, than those with albumen of a mealy or starchy nature.

For the process of germination the seed requires several things:—

1. Moisture, to expand and soften the cells and the cell-membrane.
2. Heat, to excite the dormant nitrogenous cell-contents.
3. Air, to give oxygen, in order to combine with the carbon of the seed-cells to form carbonic-acid gas.
4. Absence of light.

The diastase (from the nitrogenous cell-contents) now converts the starch into dextrine and sugar; this forms, for a time, the food of the growing embryo: the *radicle*, or rudimentary root, now bursts through, and there appears the *plumule*, or rudimentary stem.

In monocotyledonous plants (generally with *albuminous* seeds), the radicle and plumule pass through a sheath; in dicotyledonous plants, they make their appearance *between* the cotelydons (*see* seed of nux vomica), the radicle bursting through the *micropyle*.

5. *Food of the Plant.*—This is of various descriptions: it is always taken up in either a fluid or a gaseous condition. It is—

1. *Organic*, or capable of building-up organic structures.
   - (α) Cellulose group—Oxygen, carbon, hydrogen.
   - (β) Azotized group—Nitrogen, sulphur, phosphorus.
2. *Inorganic*, taken up, and remaining in the tissues, as mineral salts—
   - (α) Chlorine group.
   - (β) Alkalies and earths.
   - (γ) Metals, as iron, manganese, &c.

The removal of these special foods from the soil necessitates their renewal, either in the shape of manures or by the rotation of crops, giving time for the soil to recover itself. The simple mention of this subject gives an idea of the practical importance of the many lessons taught us by the study of the science of Botany.

SECTION III.

CHEMISTRY.

We purpose in this section to sketch out a course of reading on the Elements of Chemistry. The outline of subjects to be studied is here given; the details must be filled in from the chemical text-books. We will divide our subject as follows:—

Part I. Physics and Laws of Chemistry.
,, II. Simple Primary Analysis.
,, III. Detection of Adulterations.
,, IV. Poisons.
,, V. Chemicals of the Pharmacopœia.

PART I.—Physics and Laws of Chemistry.

This division gives an insight into the laws of matter and force. Matter is that which exists, "Ens"; its ultimate particles are atoms, unchangeable and indestructible; and these atoms, different in their nature, have received the name of "elements." Therefore an *atom* may be considered as the smallest indivisible particle of an elementary body;—the smallest portion of any substance, simple or compound, that can exist alone has received the name of *molecule:* thus one molecule of ammonia contains three atoms hydrogen and one atom nitrogen; one molecule hydrogen consists of two atoms hydrogen. The aggregation of these atoms constitutes in one case a mineral, in another case a vegetable or animal formation; the consideration of the change of condition which atoms have undergone from all time, and will to the end of time undergo, in the building-up of these various formations, forms the science of Chemistry. Each atom has in itself an amount of inherent force, variable in atoms of different natures, but indestructible; liable, indeed, to change in direction, though not in amount. The accumulation of this force throughout nature assumes different phases, and has received various names: in the complicated organic structures, endosmose, circulation, and the many movements that have received the generic term of "vital force;" in the inorganic world, (*a*) gravity, (*b*) motion, (*c*) heat, (*d*) light, (*e*) electricity, (*f*) magnetism, (*g*) chemical action. These are considered interchangeable, though the collective force of the world remains ever the same: the force that disappears on one side necessarily reappears on the other; it is as indestructible and imperishable as matter itself.

(*a*) Gravity.—The attraction or mutual tendency of *masses* of bodies towards each other, as exemplified in the influence produced by the earth on bodies immediately connected with it. *Cohesion,* on the other hand, is the tendency of molecules of bodies to cohere *inter se.* Cohesion operates at *sensible*, gravitation at *insensible* distances. Gravitation is that force which maintains the earth and other planetary bodies in their position in space, and which causes free bodies to fall to the ground. Specific gravity is the amount of this force of gravity possessed by one body as compared with that possessed by another of a different nature, or the *relative* weights of *equal* volumes:—

Ex. gr.—Taking water as the standard, we find the weights of an equal volume of other substances, and compare them to water taken as unity, or to each other.

There are various manipulative operations necessary for finding the specific gravity of a body, all given in any text-book of chemistry. Weights and measures are simply examples, in daily use, of the acknowledged fact of *relative gravity*.

(*b*) MOTION.—The force showing itself in the passage of atoms from one position to another; it readily changes to another phase of force:—

Ex. gr.—That force which, in the gradual combustion of the human frame, comes into play as chemical action, changes into motion when the hand rubs together two sticks or glass and cloth. In the former case it appears as heat, in the latter as electricity; but it is the same force simply changed in outward form; the same, though exhibited in the successive phases of chemical force, motion, heat, and electricity. In the case of a wooden cone revolving in a hollow cone of metal, by the action of a water-stream or the wind, the *motion* will produce sufficient *heat* to warm an apartment.

(*c*) HEAT—The evidence of excited force, producing many important phenomena:—

1. *Expansion.*—Heat causes atoms to lie less closely: thus bodies occupy more space when heated. This has been taken advantage of in the thermometer: with cold, the mercury contracts or falls; with heat, all bodies —gases, liquids, solids—expand.
2. *Conduction or Transmission.*—The communication of force from one atom to another, with variable rapidity in different elements. Heat stored up by a molecule is termed *latent heat*, and this varies in molecules of different natures. Matter in a gaseous form has more latent heat than in a liquid; more also in a liquid than in a solid form, and this is natural: for if heat be taken as the force *repelling* atoms *inter se*, then before a collection of molecules in the liquid state can assume the close union of a solid they must get rid of a portion of this force, and *vice versâ*: thus ice takes up heat on thawing.

The motion of heated molecules of water is the motive power in the steam-engine.

That the molecules of liquid bodies possess this mutual repellent force is proved by evaporation; that which occurs when one gas diffuses itself through other gases is seen when the atoms of water pass in a state of vapour into the air. This repulsion, which may be considered as a convertible term with heat and motion, is counteracted at ordinary temperatures by the superincumbent weight (or gravitation) of the atmosphere, and by cohesion (or absence of heat and motion). Yet, in the case of water, it exerts so much power, or rather the molecules have so much inherent repellent *force*, that at ordinary temperatures they assume, though slowly, the gaseous form; if external heat be applied, or the pressure of the atmosphere lessened, this evaporation takes place with greater violence. This explains the principle of the barometer. The removal of this repelling force, by the application of intense cold, will often cause the atoms of a gas to adhere in the liquid form; it may also be overcome by great pressure. The molecules of various substances possess various degrees of force, therefore also of heat: this is *specific* heat.

Latent heat is the force possessed by the same atom in different circumstances.

Specific heat is the force possessed by the atoms of one element as opposed to those of another element.

The atoms of elementary bodies are aggregated by varying inherent degrees of force, and have therefore varying capacities for heat; this property of matter is *specific heat*, as regards the atoms of one element opposed to those of another, and *latent heat*, as regards the atoms of the individual element in relation to its varying conditions.

3. *Radiation.*—The passage of heat from a body; a *conduction* or communication of this force to atoms in a gaseous condition. This proceeds in waves.

The physical characters of the surface of a body often have a great influence on the waves of heat. A bright surface will reflect, a dull surface radiate, a black surface absorb heat.

Reflection—Rays of heat from without falling on a body and thence recoiling.

Radiation—Heat from the body itself passing into air.

Absorption—Heat from without falling on and being retained by the body.

(*d*) LIGHT.—Like heat (and also sound), the *vibratory* motion of atoms.

1. *Reflection.*—The rebound of the ray of light (or heat) from an opposing surface.
2. *Refraction.*—The bending back (or towards the perpendicular) of a *pencil* of light passing obliquely from a rarer into a denser medium, and *vice versâ*. A prism refracts twice, once on the entrance of the *pencil* into the glass, and once on its exit. A ray of solar light consists of three waves, each with vibrations of greater or less rapidity, and giving the appearance of different colours; overlapping each other, and producing four intermediate or semi-waves. Now the red (or heat) wave is the least, the violet (or chemical) semi-wave the most refrangible; therefore the result of this double refraction is the spectrum of the seven "prismatic colours."
3. *Polarization.*—The severance of a ray of light into two poles or sides, each having a plane of incidence at right angles to the other, by absorption, unequal refraction or reflection of the ray in one of its planes. The "polarized ray," in either of its planes, has now acquired peculiar properties; amongst others, that of being partially stopped by certain transparent substances.

(*e*) ELECTRICITY.—A manifestation of excited force of a twofold nature. The opposite phases of this force have received the names of *positive* and *negative* electricity. Substances in which is developed the force of an opposite nature attract; those possessing electricity of a similar nature repel each other.

Electricity may be induced—

(1) By the friction of vitreous, resinous, and metallic surfaces.
(2) By chemical action; *i. e.*, by a galvanic battery of cells.
(3) By the attraction and repulsion (mutual contract) of a vast number of bodies.

(*f*) MAGNETISM may be termed permanent electricity. It obtains in most metals, and is an induced *permanent* condition of atoms arranged with negative and positive poles. One end of an iron magnet, being *negative*, attracts other pieces of iron: to the extremities of these pieces of metal it imparts a *positive* character.

(*g*) Chemical Action.—This is the main-spring of all the various synthetical and analytical operations that constitute the practical portion of the science of Chemistry, and may be defined as the exhibition of force under varied phases of repulsion and attraction; the effects of such force being the splitting-up of molecules, and the assumption of fresh groupings and arrangements by their component atoms.

CHEMISTRY.

Chemistry may be characterized—first, as the study of bodies *at rest*, their properties, and general nature—in other words, the consideration of *matter* alone and by itself; secondly, as the study of matter as combined with force, or the aspect of the elements in their numberless combinations, and also the varied decompositions of these bodies, simple and compound. All matter, when resolved into its ultimate atoms, is found to consist of one or more of the elements, of which the following are the principal:—

Names.	*Symbols.*	*Combining Weight.*
Aluminium	Al	27·4
Antimony	Sb	122
Arsenic	As	75
Barium	Ba	137
Bismuth	Bi	[208] 210
Boron	B	11
Bromine	Br	80
Cadmium	Cd	112
Calcium	Ca	40
Carbon	C	12
Chlorine	Cl	35·5
Cerium	Ce	92
Chromium	Cr	52·5
Cobalt	Co	58·7
Copper	Cu	63·5
Fluorine	F	19
Gold	Au	197
Hydrogen	H	1
Iodine	I	127
Iron	Fe	56
Lead	Pb	207
Lithium	Li	7
Magnesium	Mg	24
Manganese	Mn	55
Mercury	Hg	200
Nickel	Ni	58·7
Nitrogen	N	14
Oxygen	O	16
Phosphorus	P	31
Platinum	Pt	[197·8] 197·5
Potassium	K	39·1
Selenium	Se	[79] 79·5
Silver	Ag	108
Silicon	Si	[28·5] 28
Sodium	Na	23
Sulphur	S	32
Strontium	Sr	87·5
Tin	Sn	118
Zinc	Zn	[65] 65·2

They are each indicated, in usual chemical language, by a symbol, generally the first or first two letters of the name, and this symbol not only represents the actual element, but also its combining power or proportion. It is an acknowledged fact that the atoms of the several elements are of different weights; the figures against each element represent these *relative* weights; the preceding table being built-up on the idea of hydrogen as the unit. Moreover, these relative weights of atoms of necessity represent their *combining* proportion; for if, in the molecule of hydrochloric acid (HCl), the atom of chlorine is 35·5 times as heavy as the atom of hydrogen, then, on the self-evident axiom that masses of atoms must have the same relative proportion as the individual atoms, it follows that a weight of chlorine 35·5 times that of the hydrogen must be brought forward to combine together atom to atom; and this holds good in all decompositions and formations: in potassium iodide the relative weights of the individual atoms are as 39·1 to 127; therefore the combining proportions are 127 parts of iodine to 39·1 of potassium.

Multiple Proportion.—It follows, as a matter of course, on the preceding statement, that the elements can only combine in the relative weights of their respective atoms; then, in the cases where there are two or more atoms of one element, it must be in the proportion of twice or more its combining weight: thus, carbonic oxide, CO, contains 16 parts of oxygen to 12 of carbon; carbonic dioxide, CO_2, contains 32 parts of oxygen to 12 of carbon.

Atoms.—We have already given a definition of an atom and a molecule. We have now to consider *the expression*, by the various groupings of the symbols, of the many complex substances we have to take under our consideration.

We may classify the composition of the molecules of all bodies under four distinct types; these different types depend on what is called quantivalence: the meaning of this is that, in the formation of a perfect molecule, some elements require one atom, some two, three, or more atoms of monatomic hydrogen for the complete saturation of each individual atom. We may observe, moreover, in the saturation of a tetratomic element (carbon), that a diatomic exerts the power of two monatomic atoms. We now give the four types:—

1st Type—*Hydrochloric Acid.*	2nd Type—*Water.*	3rd Type—*Ammonia.*	4th Type—*Marsh Gas.*
(Univalent.)	(Bivalent.)	(Trivalent.)	(Quadrivalent.)
H	O	N'''	C''''
$\left.\begin{matrix}H\\H\end{matrix}\right\}$ Hydrogen, or $H\}H'$	$\left.\begin{matrix}H\\H\end{matrix}\right\}$ O'' Water.	$\left.\begin{matrix}H\\H\\H\end{matrix}\right\}$ N''' Ammonia.	$\left.\begin{matrix}H\\H\\H\\H\end{matrix}\right\}$ C'''' Marsh gas.
$\left.\begin{matrix}H\\Cl'\end{matrix}\right\}$ Hydrochloric acid, or $Cl\}H'$	$\left.\begin{matrix}K\\K\end{matrix}\right\}$ S'' Potassium sulphide.	$\left.\begin{matrix}H\\H\\H\end{matrix}\right\}$ As''' Hydrogen arsenide.	$\left.\begin{matrix}H\\Cl_3\end{matrix}\right\}$ C. Chloroform.

In these types there may be—

(*a*) A substitution of one of the atoms of hydrogen by a compound radical (in other words, a molecule taking the place of an atom).

(*b*) Doubling of each of the atoms, on the type of two molecules of hydrogen, water, &c.

EXAMPLES:—

(*a*) 2nd Type . . . . $\left.\begin{matrix}H\\NO_2\end{matrix}\right\}O.$ Nitric acid.

$\left.\begin{matrix}H\\C_2H_5\end{matrix}\right\}O.$ Alcohol.

(*b*) 2nd Type, *doubled* . . $\left.\begin{matrix}H_2\\(SO_2)''\end{matrix}\right\}O_2.$ Sulphuric acid.

trebled . . $\left.\begin{matrix}(PO)'''\\H_3\end{matrix}\right\}O_3.$ Phosphoric acid.

In the phraseology of modern chemical science we may remark—

1st. The tendency that there is to represent a salt, not as having two sides, base and acid, but as consisting of a whole or as one molecule: thus Potassium carbonate is preferable to Carbonate of potass, Ferrous sulphate to Sulphate of iron.

2nd. All acids are represented as hydrogen compounds:

HCl. Hydrochloric acid.
H_2SO_4. Sulphuric acid.
H_3PO_4. Phosphoric acid.

3rd. Salts are represented as of the metals, and *not* of the metallic oxides: thus, K_2SO_4. Potassium sulphate, instead of
KO, SO_3. Sulphate of potassa (oxide of potassium).

4th. In the notation that is now generally adopted the combining value of several elements (O, C, S) has been doubled.

There are, moreover, several subjects in Chemistry that are beyond the scope of the present sketch, but yet which would well repay time devoted to them, both as regards the interest afforded by their study and the amount of knowledge to be gained in their investigation. Amongst these are—

(*a*) Spectrum analysis.
(*b*) Quantitative and organic analysis.
(*c*) The various forms assumed by bodies, such as:—

1. *Crystallogy.*
2. *Allotropic condition*, or the several forms assumed by the same body.
3. *Isomerism*, or the grouping of the same atoms in more than one way, so as to form molecules of different natures.
4. *Isomorphism*, similarity of crystalline condition between dissimilar bodies.

The metrical system is now daily making rapid strides among practical workers as well as men of science, and a knowledge of it is now essential to the student of medicine or pharmacy. It receives its name from *mètre*, the unit of length (*μέτρον*, a measure). Its essential divisions are as follows:—

LENGTH.—Unit, *mètre* = 39·37 inches. It was supposed to be contained ten million times in the distance between the pole and the equator, following the arc of the meridian at the level of the sea.

Increasing by Greek numerals: *decamètre*, 10 mètres; *kilomètre*, 1,000 mètres.

Decreasing by Roman numerals: *decimètre*, $\frac{1}{10}$ mètre; *centimètre*, $\frac{1}{100}$ mètre.

CAPACITY.—Unit, *litre* = 61·027 cubic inches. This is the cube of the decimètre, or a cube measure of $\frac{1}{10}$ mètre.

Decalitre, 10 litres; *decilitre*, $\frac{1}{10}$ litre.

WEIGHT.—Unit, *gramme* = 15·432 grains. This is the weight of a cubic centimètre of distilled water, weighed in vacuo, at 4° Centigrade (the maximum density of water).

Decagramme, 10 grammes; *kilogramme*, 1,000 grammes = 2·2046 pounds avoirdupois.
Decigramme, $\frac{1}{10}$ gramme = 1·54 grains.

SURFACE.—Unit, *are*, or 100 square mètres; *centiare*, or square mètre; *hectare*, or 10,000 square mètres.

The monetary decimal system is beyond the scope of the present work.

ORGANIC CHEMISTRY.

The consideration of the chemistry of organic tissues and their secretions; but, with the breaking-down of the walls between the so-called organic and inorganic kingdoms, the term has acquired simply an artificial signification. Since, however, the structures and secretions of this division of matter are of a much higher order than the simpler compounds of the "inorganic" world, it necessarily follows that the molecules of these bodies possess a more complex nature; their composition is less stable and well defined, and their chemistry generally is found to be of a more complicated character, and embracing a far wider field of research.

These bodies have been by some chemists named the *carbon compounds*, from the fact that the molecules of the greater number contain carbon, associated with a varied number of atoms of oxygen, nitrogen, and hydrogen.

These bodies admit of systematic classification to a very great degree, either in (*a*) *groups*, as alcohols, ethers (respectively hydrates and oxides of compound radicals), acids, ammonias (on the *ammonia* type), &c.; in (*b*) *series*, called *homologous*, of compound radicals, &c., of alcohols, &c., which have received this name because the members of such a series are all built-up on the same type, but with regular successive additions in their number of atoms—the diatomic alcohols form such a series; in (*c*) *divisions*, from their similar physical nature and properties, as sucroses (with starch, gum, &c.), glucosides, benzol group, alkaloids, &c. The enormous and daily-increasing number of these compounds may tend to give us some faint idea of the wonderful extent of the science of Chemistry.

PART II.—**Simple Analysis.**

Each base and each acid (which together form the molecule of a salt) has special tests, *i. e.*, special reactions; or an exhibition of chemical action, on the addition of some other body, which shows itself to the senses by precipitation, change of colour, development of heat, &c.

The following arrangement shows the special tests for the *principal* bases and acids. The arrangement of these tests in groups is intended to enable an *unknown* salt to be determined; this classification shows the direction in which lies the practical use of analysis.

In practical analysis we divide the metals into five groups, according to the manner in which they are affected by certain reagents; we, therefore, consider their reactions in these several groups. (*Marked or essential characters are printed in heavy Egyptian type.*)

Metal.	*Reagent.*	*Precipitate, &c.*
Group I.—Precipitated from their solution by Hydrochloric Acid, or HCl.		
Silver Ag.	**Hydrochloric acid, or HCl**	**White, curdy; insoluble in nitric acid, soluble in ammonia.**
	Hydrogen sulphide	Black.
	Sodium phosphate	Pale yellow.
	Ammonium arseniate	Chocolate-coloured.
Lead Pb.	HCl	White; soluble in *hot* water; and blackened by hydrogen sulphide.
	Hydrogen sulphide	**Black.**
	Dilute sulphuric acid	White; only slightly soluble in strong acids.
	Potassium iodide	**Bright yellow;** soluble in boiling water.
	Potassium chromate	**Yellow,** becoming **red** on boiling with lime.
Mercury Hg. (As mercurous salt.)	HCl	White (calomel); blackened by **ammonia.**
	Potassium iodide	Green.
	Ammonia	**Black.**
	A piece of bright copper, with heat	**A coating of mercury.**
Group II.—Precipitated by Hydrogen Sulphide, or H_2S.		
Copper Cu.	Hydrogen sulphide, or H_2S	Black; insoluble in ammonium sulphide.
	Ammonia	**Light blue;** on further addition of ammonia dissolving to dark blue solution.
	Caustic potassa or soda (Potassium or Sodium hydrates).	**Light blue; insoluble, but turning black on boiling.**
	Potassium ferrocyanide	Brownish red.
	In an alkaline solution, an **arsenic** salt	**Green.**
	A piece of ***bright*** iron	An incrustation of copper.
Mercury Hg. (As mercuric salt), *ex. gr.*, corrosive sublimate.	H_2S	Black; insoluble in ammonium sulphide.
	Potassium iodide	**Bright scarlet;** redissolving in excess.
	Ammonia	White; of amido-chloride.

Metal.	*Reagent.*	*Precipitate, &c.*
ARSENIC As. (*See also the Division on* POISONS.)	**H_2S**	**Yellow;** soluble in ammonium sulphide.
	Bright copper	**Coating of metallic arsenic.**
	Cuprous sulphate and ammonia	Green.
	Silver nitrate and ammonia	Yellow.

Silver nitrate to arsenic acid (arsenious acid oxidized with a nitrate) gives a chocolate-coloured precipitate.

Also the **shape of sublimed crystals:** the odour (alliaceous), on the application of heat, the combustion of hydrogen arsenide **giving a deposit (on a cool surface) of the metal (Marsh's test), soluble in "calc. chlorata" solution,** but scarcely in ammonium sulphide solution.

Metal.	*Reagent.*	*Precipitate, &c.*
ANTIMONY Sb.	H_2S	**Orange;** soluble in ammonium sulphide.
	The **chloride** in solution, **dropped into water**	**White;** dissolving in tartaric acid.
	If sublimed	An **amorphous** mass.
	Bright copper	Coating of metallic antimony.

Marsh's test as for arsenic, but the coat (or mirror) of the metal **is not soluble in "calx chlorata" solution.**

Metal.	*Reagent.*	*Precipitate, &c.*
BISMUTH Bi.	H_2S	Black.
	Ammonia	White; **insoluble in excess.**
	The **chloride** in solution, **mixed with water**	**White** (of oxychloride).
TIN Sn.	H_2S	**Dark brown.**
	Mercuric chloride	White crystalline, **changing** to **grey** metallic mercury.
As Stannous salt	Gold chloride (perchloride)	**Purple** of Cassius).
As Stannic salt	H_2S	Yellow.
	Potassa	White, **bulky;** soluble in excess

Group III.—Precipitated by Ammonium Sulphide, AmHS.

Metal.	*Reagent.*	*Precipitate, &c.*
ALUMINIUM Al.	Ammonium sulphide, AmHS	White, **gelatinous.**
	Potassa (Potassium oxide)	White; soluble in excess.
	Ammonia	**White; insoluble in excess.**
IRON Fe. (Ferrous salt), as sulphate (protosulphate).	Ammonia	Whitish, turning to dirty green and brown.
	AmHS	Black.
	H_2S	No precipitate.
	Potassium ferrocyanide	**White,** turning blue.
	,, **ferridcyanide**	**Dark blue.**
	Ammonium carbonate	**White,** turning rapidly green and brown.

(Ferric salt), as perchloride.	AmHS	Black.
	Potassium ferrocyanide	**Dark blue** (Prussian blue) [Cyanuretum ferroso-ferricum].
	Ammonia	**Red-brown; insoluble in excess.**
	H_2S	Whitish (sulphur).
MANGANESE Mn.	AmHS	Flesh-coloured, becoming brown on exposure to air.
ZINC Zn.	**Ammonia**	White; **soluble in excess.**
	AmHS	White; soluble in strong, but insoluble in weak acids (as acetic).

Chromium, Cobalt, and Nickel are in this group.

Group IV.—Precipitated by Ammonium Carbonate, or Am_2CO_3.

CALCIUM Ca.	Ammonium carbonate	White; insoluble in excess; (calcium sulphate is slightly soluble).
	Ammonium oxalate	
	Sodium sulphate, sodium phosphate	
BARIUM Ba.	Am_2CO_3	White.
	Potassium chromate	Yellow; insoluble in acetic acid.
	Sulphuric acid (dilute)	White; insoluble in strong acid.
	An alkaline phosphate	White; soluble in acetic acid.
MAGNESIUM Mg.	Am_2CO_3	White; soluble in ammonium chloride.
	Ammonio-sodium phosphate	White (of ammonio-magnesium phosphate).

Strontium is in this group.

Group V.

SODIUM Na.	Flame-test, the flame being coloured yellow	All its salts are soluble; the tests for potassium giving no reaction.
POTASSIUM K.	Platinum chloride	Yellow (of the double chlorides).
	Tartaric acid	White, granular.
AMMONIUM Am	Caustic soda	Pungent odour of ammonia.
	Heat	Entire volatilization.

ACIDS.

Acid.	*Reagent.*	*Precipitate, &c.*
HYDROCHLORIC ACID HCl.	**Silver nitrate**	**White, curdy;** soluble in ammonia, insoluble in nitric acid.
SULPHURIC ACID H_2SO_4.	**Barium chloride,** or barium chloride and nitric acid.	**White precipitate; insoluble in strong acids, and insoluble on boiling.**
NITRIC ACID HNO_3.	**A crystal of ferrous sulphate,** and a few drops **sulphuric acid** conveyed to bottom of tube.	**Black line** between the layer of acid (at bottom) and the nitrate solution.
	Copper and sulphuric acid	**Orange-red fumes.**
	Hydrochloric acid added to a solution	Dissolves gold-leaf (from presence of free chlorine).
ACETIC ACID $HC_2H_3O_2$.	Sulphuric acid	Acetous odour evolved.
	Heat applied to a dry acetic salt	Decomposition and **characteristic odour of acetone.**
CARBONIC ACID H_2CO_3.	Passed into lime-water (*a*), or solution of lead diacetate (*b*).	White insoluble precipitate of "chalk" (*a*) (calcium carbonate) or lead carbonate (*b*).
HYDROCYANIC ACID	See Division on "Poisons."	
OXALIC ACID		
PHOSPHORIC ACID H_3PO_4.	**Silver nitrate**	**Light yellow; soluble in ammonia and nitric acid.**
	Calcium chloride (*a*), Barium chloride (*b*)	White; soluble (*a*) in acetic acid, (*b*) in hydrochloric acid
	Magnesium salts, in presence of ammonia	White crystalline precipitate.
TARTARIC ACID $H_2C_4H_4O_6$.	**Calcium chloride** (added to a *neutral* tartrate solution).	**White; soluble in cold caustic potassa** (Potassium hydrate).
	Potassium salt (in solution)	**White, crystalline** (of bitartrate).
	Silver nitrate	White, **blackening** by boiling.
	Sulphuric acid, strong	**Blackens and chars.**
CITRIC ACID $H_3C_6H_5O_7$.	**Calcium chloride** (as above)	White; **insoluble** in cold caustic potash.
	Mercurous nitrate	White, becoming grey.

Silver citrate does **not** turn black on boiling, as is the case with silver tartrate.

PART III.—Adulterations of Principal Chemicals and their Detection, and Tests for their Purity.

The "British Pharmacopœia" may with advantage be consulted to extend and amplify this Section.

		Tests and Characteristics.	
Article.	*Adulteration.*	*Genuine.*	*Adulterated.*
SULPHUR [PRECIPITATED]	Calcium sulphate (often two-thirds).	Evaporates on application of heat	Non-volatile.
		Microscope—Granular	Crystalline.
SULPHURIC ACID	Organic matter	Colourless	Colour.
	Nitrous acid	On dilution, clear	Iron sulphate colours black; muddiness.
	Lead sulphate	*Hydrogen sulphide*—No colour	Black.
	Arsenic	*Hydrogen sulphide*—No colour	Yellow.
PHOSPHORIC ACID [DILUTE]	Lime (calcium oxide)	*Sodium carbonate*—No precipitate	White precipitate.
	Sulphuric acid	*Barium chloride*—No change	White precipitate.
	Hydrochloric acid	*Silver nitrate*—No change	White curdy precipitate.
NITRIC ACID	Nitrous acid	Colourless	Yellow colour.
IODINE	Moisture	Should not adhere to side of a dry bottle.	Damp, adhesive appearance.
HYDROCHLORIC ACID	Chlorine	*Gold*—Not dissolved	Dissolves (tested by stannous chloride).
	Metals	*Ammonia or its carbonate*—No precipitate.	Precipitate.
AMMONIA [LIQUOR]	Tarry products	*Sulphuric acid*	Reddens if added in excess.
	Lime	*Oxalic acid* . No change	Precipitate, white.
	Carbonic acid (from atmosphere).	*Lime-water* .	Precipitate, white.
POTASSA [LIQUOR] (Potassium hydrate, in solution.)	Carbonic acid	*Lime-water*—No change	Milkiness.
	Lime	*Sodium carbonate* (after saturation with nitric acid).	White precipitate.

SECT. III.—**Chemistry**—*continued.*

Article.	*Adulteration.*	*Tests and Characteristics.*	
		Genuine.	*Adulterated.*
POTASSIUM IODIDE	Water	*Heat*—Loses no weight	Loses weight.
	Potassium iodate	*Tartaric acid and starch*—No change	Development of a blue colour.
	Potassium carbonate	*Alcohol*—Soluble in it	Not entirely soluble.
		Lime-water	White precipitate.
	Potassium (chlorides, &c.)	*Silver nitrate and ammonia*—A precipitate, insoluble in ammonia.	A white precipitate, soluble in ammonia.
	Potassa	*Turmeric* No change	Browned.
	Sulphates	*Barium chloride*	White precipitate.
	Bromide	*Chlorine water and starch*	Yellow colour.
POTASSIUM CARBONATE	Sulphates, chlorides, or carbonic acid.	Usual tests.	
,, BICARBONATE (Hydric potassium carbonate.)	Sulphate	Usual tests.	
	Chloride		
	Carbonate		
,, NITRATE	Nitric acid	Usual tests.	
	Potassa		
	Sulphates and chlorides		
SODIUM BICARBONATE (Hydric sodium carbonate.)	Sodium carbonate	*Magnesium sulphate*—No precipitate	White precipitate (in cold).
	Sulphates and chlorides	Usual tests.	
MAGNESIUM CARBONATE	Alkaline carbonate	*Turmeric*—No alteration	Browned.
	Sulphates and chlorides	Usual tests.	
ZINC OXIDE	Calcium carbonate	*Strong acid*—No change	Effervescence.
	Lead sulphate	*Barium chloride, in nitric acid solution*	Gives white precipitate.
	Iron	Soluble in ammonia	Insoluble.
,, SULPHATE.	Copper sulphate	*Ammonia* No change	Blue colour.
	Lead	*Hydrogen sulphide*	Black precipitate.
	Arsenic	*Hydrogen sulphide*	Yellow precipitate.
	Iron	*Ammonia, in nitric acid solution*—White precipitate; soluble in excess.	Yellow-brown; insoluble in excess.
		Tinct. gallæ—No alteration	Black precipitate.

,, Valerianate	Simply oil of valerian added to a salt of zinc.	Insoluble in cold water	Soluble in cold water, with thin film of oil on water.
		Strong acid—Sets free valerianic acid	Little or no acid set free.
,, Acetate	The adulterations are generally insoluble in dilute sulphuric acid, or the *ammonia precipitate* is insoluble in excess.		
Plumbic Oxide [red]	Red earths		Insoluble in nitric acid.
,, Carbonate	Barium carbonate or sulphate		Insoluble in nitric acid.
,, Acetate	Sulphates	*Barium chloride*	White precipitate, almost insoluble in water.
Bismuthic Subnitrate	Bismuth carbonate	*Nitric acid*	Causes effervescence.
	Lead carbonate Calcium phosphate	*Dilute sulphuric acid to nitric acid solution*—No precipitate.	White precipitate.
	Chlorides	*Silver nitrate*	White precipitate.
Antimonous Sulphide	Iron sulphide	*Hydrochloric acid*—Soluble, colourless, giving a white precipitate of oxychloride on dilution with water.	Develops yellow colour; giving, with ammonia, yellow-brown precipitate.
	Lead	Test for lead (as above), after the precipitation of the antimony.	
	Copper	*Ammonia*	Develops blue colour.
Antimony Potassium Tartrate.	Potassium bitartrate	*Soluble* in water	Insoluble in water.
	Iron	*Potassium ferrocyanide*—No precipitate.	Blue precipitate.
Mercuric Iodide	Mercurous iodide	*Calcium chloride*—Soluble.	Insoluble.
Mercurous Chloride	Mercury perchloride (mercuric chloride).	*Water*—Insoluble	Soluble; detected in solution by potassium iodide (scarlet precipitate) or silver nitrate.
	Barium sulphate.	Volatilized by heat	Remains after incineration.
Mercuric Ammonium Chloride,	Calomel (mercurous chloride).	*Lime-water*	Gives a black colour to the powder.
	Calcium carbonate	*Hydrochloric acid*	Effervescence.
	Lead (α) Starch (β)	*Potassium iodide after digestion in acetic acid*—No reaction.	Yellow precipitate (α), or blue colour (β).

Article.	*Adulteration.*	*Tests and Characteristics.*	
		Genuine.	*Adulterated.*
MERCURIC SULPHIDE	Dragon's blood (powdered)	*Alcohol*—Insoluble	Soluble, imparting colour.
	Red lead		As above for lead.
	Red arsenic (realgar)		Usual tests for arsenic.

Adulterations of Organic Chemicals.

QUINIA		*Ammonia*—Precipitates, colourless. *Chlorine and ammonia*—Clear green colour.	
	(α) Cinchonine	*Ether*—Soluble in ether	Insoluble in ether (α).
	(β) Quinidine	*Lime-water*—Dissolves quinine.	Insoluble in lime-water; much less soluble in ether than quinine (β).
	(γ) Calcium sulphate	*Heat*—Entirely volatilized	Remains on incineration (γ).
	(δ) Sugar, starch, &c.		On removal (by ammonia) of the quinine from the water solution these (δ) remain, and may be detected on evaporation.
		Sulphuric acid, strong—Does not affect in colour.	Blackens and chars (δ).
	(ε) Salicine	*Sulphuric acid*—Does not affect in colour.	Red colour produced (ε).
		Test for quinidine and cinchonine	If the salt is dissolved in sulphuric acid, ammonia and then ether added, on standing the two adulterations will appear on the line between the solutions of ether and ammonium sulphate (α β).
MORPHIA	Colouring matter; salicine, and impurities similar to those noticed under Quinia.	Tests in section on "Toxicology." Colourless *Heat*—Volatilized. *Potassa*—White precipitate, soluble in excess.	See reactions (γ δ ε) under Quinia.

		“ Toxicology.”	
	Brucine	*Nitric acid*—Does not colour	Produces deep red (even noticeable in inner bark of the *Strychnos nux-vomica*).
	Lime or magnesia	*Oxalic acid*—Dissolves strychnia	Insoluble in oxalic acid.
GLYCERINE	Lead	Colourless, odourless, taste devoid of acidity	Usual tests.
	Chlorides or sulphates		
	Acids	*Blue litmus paper*—Not reddened	Reddened by an acid.
ACETIC ACID	Hydrochloric or sulphuric acid.	*Silver nitrate or barium chloride*—No reaction.	White precipitate in either case.
	Nitric acid	*Silver*—After digestion of silver-leaf; no precipitate with hydrochloric acid (no silver dissolved).	Some of the silver is dissolved by the nitric acid, and hence a precipitate of chloride.
	Metals, &c.	*Ammonia, hydrosulphuric acid, and potassium ferrocyanide.*	Usual reactions.
CITRIC ACID	Tartaric acid	*A soluble salt of potash*—No precipitate	White precipitate (of acid tartrate).
TARTARIC ACID	Acid potassium tartrate	*Water*—Soluble	Insoluble (or nearly insoluble).
	Lime, earthy impurities	*Heat*—Decomposes	Remains after incineration.
SPIRITUS ÆTHERIS NITROSI	Alcohol, water	*Specific gravity*, ·850	Different specific gravity.
	Nitrous acid	Colourless	Coloured (tinged with brown).
CHLOROFORM	Alcohol and ether	*Specific gravity*	Lessened by alcohol.
		Fire—Not immediately inflammable	Immediately inflammable.
		Dropped into water—The *drop* falls *bright.*	The surface of the *drop* becomes opaline.
	Heavy volatile oils	*Sulphuric acid*—No coloration	Blackens.
	Chlorine and hydrochloric acid.	*Odour*—None unpleasant	Strong smell.
		Ammonia	Fumes of chlorine, with vapour.
		Silver nitrate—No precipitate	White precipitate,

PART IV.—**Poisons.**

Few things are more difficult than accurate definitions: this we find especially to be the case with the subject of the present remarks. Perhaps the best definition of a poison is, that it is a substance which, (1) in small quantity, (2) rapidly (3) enters into the system (4) with such power of altering the tissues as to cause death.

The common fallacy that poisons are substances opposed to animal life is a relic of the days of ignorance. The term itself, and the classification of certain articles under this name, are purely artificial; it is an empirical arrangement of those substances which, from their influence on living organic structures, are the most powerful in their effects on animal life. But a so-called poison has no *innate* hostility to living organisms; the effect produced arises simply from the vital tissues and cell-contents being modified in their molecular composition; a natural metamorphosis of matter takes place; the continuance of that expression of material forces, which has received the name of *vital action*, becomes no longer possible, and this cessation, if total, terminates the life of the individual. That the physiological action of a poison is of an injurious character depends, not on its antagonism to the healthy individual, but on the changes and modifications that it gives rise to in the structure and chemical composition of the living organism.

Viewed in their relation to the animal economy, all substances may be classed under two heads:—

1st. Those that simply serve to build up the organic tissues: this comprehends those that receive the generic term of articles of food. They consist almost entirely of organic substances, both on account of their containing the essential elements of new organic structures, and also their extreme readiness to separate into their component parts.

2nd. Substances producing some physiological effect on the animal structure other than that of simply building up the tissues. This class comprehends all medicines, and it is owing to their presence in small quantities that many articles of food are objectionable to certain systems. The more powerful among them have received the specific name of "poisons;" but that the latter is a purely artificial distinction is proved by the fact that many so-called drugs are poisonous in excessive doses, whilst most poisons are used, and with much benefit, in the modern practice of medicine.

The four qualities, therefore, that go to make up our definition of a poison exclude the following:—

1. Substances that may be dangerous in excessive doses, as Potassium sulphate or Sodium chloride (common salt).
2. Those that take a lengthened period of time before they produce a serious result: these, however, may be, as Antimony, classed sometimes as a poison, sometimes as a simple medicine.
3. Those that act simply mechanically, as boiling water, mercury (in the metallic state), &c. Strong sulphuric acid, that may produce death by ulceration of the coats of the stomach and throat, cannot, with accuracy, be classed among poisons proper.
4. Substances of little real power that might, however, have a deleterious effect on a weak constitution, or with patients of peculiar idiosyncrasies.

The following tabular arrangement gives the chief articles that have such a violent effect on organic tissues and organs, both as regards the effect produced and the rapidity of action, as to have been classed together as *poisons*. There have been several classifications: we adopt the clearest, and divide them into two great classes.

I. Poisons acting on the Nerves, or neurotic.	1. Acting on the spine	Strychnia.
	2. ,, ,, spine and brain	Conia, Aconitia.
	3. ,, ,, brain alone, or narcotic	Morphia, Hydrocyanic acid.

II. Poisons acting as simple Irritants.	1. Animal		Cantharides.
	2. Vegetable		Savin (Sabina).
	3. Mineral	α Metallic	Arsenic and other metals.
		β Non-metallic	Acids. Alkalies. Metalloids.

Poisons.		*Tests.*	*Antidotes.*
Strong Acids and Alkalies		The tests for sulphuric, nitric, and hydrochloric acids	Demulcents and emollients.
Oxalic Acid		Chloride calcium gives white precipitate, insoluble in acetic but soluble in hydrochloric acid. Sulphuric acid decomposes, but does not blacken it.	Stomach - pump; emetic; whiting or chalk and water.
Arsenic		Odour is alliaceous	a. Emetic, as zinc sulphate or copper sulphate (gr. x.).
	α Three solid tests	1. Crystallizes in octahedral crystals. 2. Reduction test. Heated with charcoal, it sublimes into an iron-grey metallic ring. 3. Reoxidation, by gentle heating, into octahedral crystals of arsenious acid.	b. Moist hydrated iron peroxide (ferric oxide), *i. e.*, a mixture of iron perchloride and sodium carbonate; at the same time, equal parts of oil and lime-water, to cause vomiting.
	β Two liquid tests	1. Silver ammonio-nitrate gives rich yellow precipitate. 2. Copper ammonio-nitrate gives green precipitate.	
	γ Gaseus test	Hydrogen sulphide gives a golden yellow precipitate.	

Poisons.	*Tests.*	*Antidotes.*
ARSENIC—*continued.*	Two processes 1. Reinsh's. Remove arsenic by boiling in the solution bright copper, which becomes coated with it; then subsequent sublimation and dissolution of sublimate for liquid tests. 2. Marsh's. Inserting the solution in a vessel where hydrogen is being generated, igniting the then formed hydrogen arsenide, which will deposit metallic arsenic in a mirror on a porcelain plate above the flame; if this flame be directed on a piece of paper moistened with silver ammonio-nitrate, it is coloured yellow.	
ANTIMONY	For Tests, see division on "Analysis"	As for arsenic; also tannic acid, or other astringent solutions; diluents.
MERCURY	See above. Also galvanic test, *i. e.*, pieces of iron and gold touching *in* the mercury solution, the mercury appears as a coat on the gold.	White of egg, or albumen; stomach-pump; flour and milk.
	Reinsh's test-process, & subsequent sublimation in metallic globules.	Hydrated iron persulphate (Mialhe).
LEAD	See above	Emetics; free use of the alkaline sulphates; purges—castor oil or croton oil; milk or albumen.
COPPER	See above	As above. Emollient injections, or castor oil; reduced iron.
SAVIN (*Sabina*)	Violent irritant. The presence of the disc-bearing woodcells of the Coniferæ is a microscopic character of the powered branches and young shoots.	Emetics.
CANTHARIDES	If cantharides have been taken internally the bright green particles of the wing-cases, even though very minute, may be almost invariably distinguished by the microscope.	Emollients.

MORPHIA & OPIUM	A cerebral poison. Affects the brain, and not the spine or muscles. If opium has been administered, it is to be searched for as morphia. (*a*) Iron perchloride gives a dark blue colour, changed to orange by nitric acid. (*b*) Nitric acid gives an orange colour. (*c*) From iodic acid free iodine is eliminated. (*d*) In a solution of opium, however, iron perchloride gives a blood-red colour, which is its action in presence of *meconic acid.* (*e*) Sulphuric acid and potassium bichromate produce green colour.	Stomach-pump; emetics, as zinc sulphate; cold affusion on headand spine; continual motion; strong and direct nervous stimulus.
HYDROCYANIC ACID . .	Poisons the blood with great rapidity. Powerful vapour. (*a*) Silver test. Silver nitrate gives a dense white precipitate, insoluble in cold, soluble in hot nitric acid; when dry and heated this silver cyanide gives off cyanogen gas, burning with a rose-coloured flame.	Ammonia; cold affusion to head and spine; the administration of the protoxide, and then the peroxide (moist) of iron (with the intention of forming Prussian blue).
	(*b*) Iron test. (*a*) Add to suspected solution potash, green iron sulphate; diluted sulphuric acid then develops *Prussian blue* [Taylor]. (*b*) Add solution of potash, iron sulphate, iron perchloride, and dilute acid; Prussian blue is precipitated.	Stimulants.
	(*c*) Sulphur test. Add to solution ammoniohydric sulphide (forming sulphocyanide) iron perchloride now gives blood-red colour.	

Among other "cerebral" poisons are alcohol, chloroform, camphor, tobacco, Cocculus indicus, and hyoscyamus. In treating an over-dose, its speedy removal is the main object; cold affusion has also been beneficial.

<table>
<tr><th><i>Poisons.</i></th><th><i>Tests.</i></th><th><i>Antidotes.</i></th></tr>
<tr><td>CONIUM</td><td>As others of this class, it affects the brain and spine, and indirectly the heart. The alkaloid is <i>conia</i>, a volatile liquid; it can be isolated, but can scarcely with accuracy be tested by reagents.</td><td>Tannic acid; animal charcoal (to absorb the alkaloid); stimulants; emetics.</td></tr>
<tr><td>ACONITUM, and its alkaloid, Aconitia.</td><td>It paralyzes the whole nervous system . . . . . .</td><td>As above.</td></tr>
<tr><td colspan="3">Belladonna, Lobelia, Digitalis, Stramonium, are all cerebro-spinal poisons; they owe their power to alkaloids, and their influence is to be counteracted as in the case of Conium.</td></tr>
<tr><td>STRYCHNIA</td><td>A purely <i>spinal</i> poison, the brain being often almost entirely unaffected. When removed (if in organic tissues, this may be done by successive boiling with hydrochloric acid, and then charring with sulphuric acid), it is recognized as under.
(<i>a</i>) Sulphuric acid and a small crystal of potassium bichromate give a brilliant violet colour, changing to red.
(<i>b</i>) Boiling sulphuric acid does not char it.
(<i>c</i>) Potassium sulphocyanide gives a white crystalline precipitate.
(<i>d</i>) <i>Intensely</i> bitter taste.
(<i>e</i>) A frog placed in a weak solution is attacked with tetanic struggles.</td><td>Emetics (before tetanus sets in); chloroform vapour (to allay the spasms). Animal charcoal, tobacco, and morphia have been occasionally used as antidotes. The essential is to remove the poison before it has been, even in a slight degree, absorbed into the system.</td></tr>
<tr><td>BRUCINE</td><td>Similar to strychnia. Nitric acid turns brucine a brilliant red colour.</td><td></td></tr>
</table>

PART V.—The Inorganic Chemicals.

In the consideration of the Chemicals of the Pharmacopœia, the Author has not judged it necessary to give in detail the preparation of each article; the student cannot do better than take the Pharmacopœia as his guide, and study, according to its direction, the various processes that are adopted in the production of these substances. As a help, however, to the clear comprehension of the chemical action that takes place, the principal decompositions are given that are attendant on these manipulative instructions, and in these diagrams the method of notation now generally employed among scientific men is made use of: the names of salts in the first column, in Egyptian type, are according to the modern theory; the nomenclature of the Pharmacopœia is given in italics or in inverted commas. The "Codex Medicamentarius" (France) and the "Pharmacopœia Borussica" have been followed in considering the names of salts (as sulphas, nitras, &c.) to be of the masculine gender.

In the following pages attention has been more especially drawn to the chemicals of the Pharmacopœia. Of many articles mention has simply been made; however, it is necessary that the student should make himself acquainted with more detailed processes and fuller descriptions: the Author cannot too strongly insist upon this necessity of studying with the following chart a more complete manual of chemistry.

Of the elements which, alone or in combination, constitute all matter, the following, either themselves or in their compounds, are used in medicine:—

NON-METALLIC ELEMENTS.

1. Carbon.
2. Sulphur.
3. Iodine.
4. Chlorine.
5. Bromine.
6. Fluorine.
7. Phosphorus.
8. Boron.
9. Oxygen.
10. Hydrogen.
11. Nitrogen.

METALLIC ELEMENTS.

I. METALS OF THE ALKALIES.—1. Sodium. 2. Potassium. 3. Ammonium (hypothetical). 4. Lithium.

II. METALS OF THE ALKALINE EARTHS.—1. Calcium. 2. Strontium. 3. Barium.

III. METALS OF THE EARTHS.—1. Aluminium. 2. Cerium.

IV. METALS PROPER.—(α) Zinc Class.—1. Zinc. 2. Magnesium (by some placed as a metal of the alkaline earths). 3. Cadmium.
(β) Iron Class.—1. Iron. 2. Manganese. 3. Cobalt. 4. Nickel. 5. Chromium.
(γ) Tin Class.—Tin.
(δ) Arsenic Class.—1. Arsenic. 2. Antimony. 3. Bismuth.
(ε) Silver Class.—1. Copper. 2. Silver. 3. Mercury. 4. Lead.
(ζ) Gold Class.—1. Gold. 2. Platinum.

NON-METALLIC ELEMENTS.

Articles.	*Characteristics.*
1. *Carbon* . . . . C.	As C. animalis; and as C. ligni, from wood. In three allotropic forms—1. Diamond. 2. Graphite 3. Charcoal.
Carbonic dioxide. CO_2.	Calcium carbonate. $CaCO_3$. Hydrochloric acid (two molecules). $2HCl$. give Calcium chloride. $CaCl_2$. **Carbonic-acid gas.** CO_2. Water. H_2O.
Carbonic oxide. CO.	
Marsh gas, or light carburetted hydrogen. CH_4.	
Olefiant gas, or heavy carburetted hydrogen. C_2H_4.	
Cyanogen . . . . CN.	A colourless gas, obtained by heating mercuric cyanide.
2. *Sulphur.* S.	
Sulphur (sublimed)	Fine but somewhat gritty powder; by microscope, small granules. Obtained by sublimation from rough sulphur. *Colour*—Bright lemon-yellow.
,, (precipitated) . . . . **Sulphur precipitatum.**	From the filtered water in which sulphur and lime have been boiled, the sulphur precipitated with hydrochloric acid, and well washed. Generally (of commerce) containing sulphate of lime; whitish yellow, soft and satiny; but if pure, light grey-yellow, and less soft in appearance. (Fig. 115.) *Odour*—*None* of sulphuretted hydrogen.

Sulphurous acid . . . . .
$H_2SO_3(SO_2+H_2O)$.
Acidum sulphurosum.

Colourless liquid. Sulphuric dioxide dissolved in water.
Odour—Pungent and sulphurous.

give

Copper (one molecule). Cu_2. Sulphuric acid (four molecules). $4H_2SO_4$.	Copper sulphate (two molecules). $2CuSO_4$. Water (four molecules). $4H_2O$. **Sulphuric dioxide** (two molecules). **$2SO_2$.** (In water it becomes H_2SO_3.)

Sulphuric acid . . . . .
H_2SO_4.
Sulphuric trioxide in water.
(SO_3+H_2O.)
Acidum sulphuricum.

Thick oily liquid, almost twice the weight of water.
Colour—White.
Odourless. Acrid, most corrosive taste; violently corrosive in its action.

give

Sulphuric dioxide. SO_2. Water. H_2O. Nitric trioxide. N_2O_3.	**Sulphuric acid.** **H_2SO_4.** Nitric oxide. N_2O_2.

In the presence of water sulphuric dioxide takes an atom of oxygen from the nitric trioxide, which, becoming nitric oxide, takes up another atom of oxygen from the air, to be again given up to a second molecule of sulphuric dioxide.

Sulphuretted hydrogen, or hydrogen sulphide.
H_2S.

give

Ferrous (iron) sulphide. FeS. Sulphuric acid. H_2SO_4.	Ferrous (iron) sulphate. $FeSO_4$. **Hydrogen sulphide.** **H_2S.**

Articles.	*Characteristics.*
3. *Iodine* . . . . I. **Iodum.**	Preparation of iodine from "kelp" (ashes of seaweeds). Obtained by heating "kelp" with sulphuric acid and manganese dioxide. In crystalline scales, with metallic lustre; violet fumes, if heated. (Fig. 294.) *Colour*—Dark blue-black. *Odour*—Peculiar, resembling chlorine. *Taste*—Acrid. Gives blue colour with starch.

	give
Sodium iodide (two molecules). $2NaI$. Sulphuric acid (two molecules). $2H_2SO_4$. Manganese dioxide. MnO_2.	**Iodine** (one molecule) **I_2.** (two atoms). Sodium sulphate. Na_2SO_4. Manganese sulphate. $MnSO_4$. Water. $2H_2O$.

Hydriodic acid.
HI.

Iodic acid.
HIO_3.

4. *Chlorine* . . . . Cl.	Gas. Yellowish green; pungent. From sodium chloride, by the same decomposition as iodine. It has strong bleaching properties.

		give
Hydrochloric acid . . . . HCl. **Acidum chlorhydricum.** (*Acidum hydrochloricum.*)	Sodium chloride. $NaCl$. Sulphuric acid. H_2SO_4.	**Hydrochloric acid.** **HCl.** Hydric-sodium sulphate. $NaHSO_4$.

Chlorous acid.
$HClO_2$.

Chloric acid.
$HClO_3$.

Perchloric acid.
$HClO_4$.

"Calx chlorata" . . . . .
(Chlorinated lime.)
Hypochloris calcicus et Chloridum calcicum.

A mixture of calcium chloride and calcium hypochlorite.

Calcium hydrate (two molecules).
$2CaH_2O_2$.
Chlorine (two molecules)
$2Cl_2$. (four atoms).

give

Calcium chloride.
$CaCl_2$.
Calcium hypochlorite.
$CaCl_2O_2$.
Water (two molecules).
$2H_2O$.

5. *Bromine* . . . .
Br.
Bromum.

Thick oily liquid; volatile. Obtained as iodine.
Colour—Deep red.
Odour—Penetrating and disagreeable.

6. *Fluorine* . . . .
F.

In fluorspar, or calcium fluoride.

Hydrofluoric acid . . . .
HF.

From calcium fluoride by the action of sulphuric acid.

7. *Phosphorus* . . . . . .
P.

Formed by treating powdered bone-dust with sulphuric acid, and heating the dried evaporated syrup with charcoal, when phosphorus distils.

Solid mass, generally run in wedges or sticks; translucent, soft, wax-like; emitting white vapour on exposure, and becoming luminous in the dark. Found, as calcium phosphate, in bones of animals.
Colour—White, turning to pink on the exterior by exposure.
Odour—Peculiar, irritating.

Phosphorus exists also in a red or amorphous condition, not inflammable below 260°.

Phosphorous acid.
H_3PO_3.

Phosphoric acid; or, when diluted . . .
"Acidum phosphoricum dilutum."
H_3PO_4.

Phosphorus (three molecules)
$3P_2$. (six atoms).
Nitric acid (ten molecules).
$10HNO_3$.
Water (four molecules).
$4H_2O$.

give

Phosphoric acid (six molecules).
$6H_3PO_4$.
Nitric oxide (five molecules).
$5N_2O_2$.

N.B.—There are several other "acid" compounds of phosphorus and oxygen.

Articles.	*Characteristics.*
8. *Boron* B.	As boracic acid in "borax"; from Tuscany and India.
Boracic acid. HBO_2+H_2O.	
Sodium borate $2NaBO_2, B_2O_3+10H_2O$. **Boras sodicus.** (*Sodæ boras.*)	Boracic acid neutralized by sodium carbonate. Crystals, generally of fair size; transparent, somewhat shining; soluble in water. (Fig. 110.) Colourless. *Taste*—Sweetish; styptic. **Tartras borico-potassicus,** soluble cream of tartar.
9. *Oxygen* O.	Gas; colourless, invisible, tasteless, odourless. [*Ozone*—nascent, active Oxygen.]
10. *Hydrogen.* H.	
Water. H_2O. **Aqua.**	
11. *Nitrogen.* N. [*Fr.* Azote.]	A colourless gas, constituting four-fifths of the atmosphere.
Nitric acid HNO_3. **Acidum nitricum.**	From potassium nitrate, by the action of sulphuric acid. Potassium nitrate KNO_3. Sulphuric acid. H_2SO_4. give **Nitric acid. HNO_3.** Hydric potassium sulphate. $KHSO_4$.

Nitrous oxide (Laughing gas).
N_2O.

Nitric trioxide, under which are the nitrites, as Potassium nitrite [**Nitris potassicus**].
N_2O_3. KNO_2.

METALS OF THE ALKALIES.

1. *Sodium* . . . . . A soft silver-white metal.
   Na.

Sodium acetate.
$NaC_2H_3O_2, 3H_2O$.
Acetas sodicus.
(*Sodæ acetas.*)

Sodium carbonate.
Na_2CO_3.
Acetic acid (two molecules).
$2HC_2H_3O_2$.

give

Sodium acetate (two molecules).
$\mathbf{2NaC_2H_3O_2}$.
Carbonic acid.
CO_2.
Water.
H_2O. (Fig. 284.)

Sodium arseniate . . . . .
$Na_2HAsO_4, 7H_2O$.
Arsenias sodicus.
(*Sodæ arsenias.*)

In the method of preparation, arsenious acid is oxidized by the nitric acid in the sodium nitrate, and then, as arsenic acid, unites with the sodium, the nitric oxide and carbonic acid being driven off by the heat. (Fig. 289.)

Arsenious acid (three molecules).
$3As_2O_3$.
Sodium nitrate (four molecules).
$4NaNO_3$.
Sodium carbonate (four molecules).
$4Na_2CO_3$.
Water (three molecules).
$3H_2O$.

give

Sodium arseniate (six molecules).
$\mathbf{6Na_2HAsO_4}$.
Nitric oxide (two molecules).
$2N_2O_2$.
Carbonic acid gas (four molecules).
$4CO_2$.

Sodium chloride . . . . . Common salt. In transparent cubic crystals, or white crystallized grains.
$NaCl$.
Chloridum sodicum.
(*Sodii chloridum.*)

Sodium-potassium tartrate . . .
$NaKC_4H_4O_6$.

" Soda tartarata."
$NaKC_4H_4O_6 + 4H_2O$.
Tartras potassico-sodicus.

In crystals, but generally met with in powder; crystals, transparent prisms.
Colourless.
Taste—Milder than, but resembling, that of common salt.

Sodium carbonate (two molecules).
Na_2CO_3.
Hydric potassium tartrate.
$2KHC_4H_4O_6$.
(Cream of tartar.)

give

Water.
H_2O.
Carbonic-acid gas.
CO_2.
Sodium-potassium tartrate.
$\mathbf{NaKC_4H_4O_6}$.

[illegible] carbonate

[illegible] pressure

Carbonas sodicus
(Soda carbonate.)

(α) Sodium chloride (two molecules) [illegible]
Sulphuric acid
H_2SO_4.

[illegible] Hydrochloric acid (two molecules) [illegible]
2HCl.

give

(β) Sodium sulphate.
Na_2SO_4.
Carbon (two molecules).
$2C_2$. (four atoms.)

Carbonic oxide (four molecules)
4CO.

give

(γ) Sodium sulphide.
Na_2S.
Calcium carbonate.
$CaCO_3$.

Sodium carbonate.
Na_2CO_3.
Calcium sulphide.
CaS.

Sodium citro-tart. eff. . . . . White granules; effervescing in water. (Fig. 185.)

Sodium hydrate . . .
NaHO.
("Soda caustica.")
Hydras sodicus.

Calcium hydrate (Lime) [illegible]
CaH_2O_2.
Sodium carbonate.
Na_2CO_3.

give

Sodium hydrate (two molecules).
2NaHO.
Calcium carbonate.
$CaCO_3$.

Sodium nitrate . . . . . . $NaNO_3$. **Nitras sodicus.** (*Sodæ nitras.*)	From Chili (found native, in large beds).
Sodium phosphate . . . . . $Na_2HPO_4,12H_2O$. (Hydric di-sodium phosphate.) **Phosphas sodicus.** (*Sodæ phosphas.*)	To a solution of acid calcium phosphate, obtained by treating bone-ash with sulphuric acid (when calcium sulphate remains), add sodium carbonate; sodium phosphate will crystallize out. (Fig. 111.) Acid calcium phosphate. CaH_42PO_4. Sodium carbonate (two molecules). $2Na_2CO_3$. give **Sodium phosphate** (two molecules). **$2Na_2HPO_4$.** Water. H_2O. Carbonic-acid gas. CO_2. Calcium carbonate. $CaCO_3$.
Sodium sulphate . . . . . . $Na_2SO_4+10H_2O$. **Sulphas sodicus.** (*Sodæ sulphas.*)	In oblique prisms. (Fig. 112.) *Colour*—Transparent white. *Taste*—Bitter. Hydric sodium sulphate ("Bisulphate") (two molecules). $2NaHSO_4$. Sodium carbonate. Na_2CO_3. give **Sodium sulphate** (two molecules). **$2Na_2SO_4$.** Carbonic-acid gas. CO_2. Water. H_2O.
Sodium valerianate . . . . . $NaC_5H_9O_2$. **Valeras sodicus.** (*Sodæ valerianas.*)	In masses; dry and amorphous; deliquescent. Fusel oil (amylic alcohol) is oxidized to valerianic acid by the action of potassium bichromate and sulphuric acid. This is then saturated with a solution of soda. (Fig. 286.) *Colour*—White. *Taste and Odour*—Of valerian.
2. *Potassium* . . . . K.	Soft silver-white metal.
Potassium hydrate . . . . . KHO. ("Potassa caustica.") **Hydras potassicus.**	Or potassa fusa (liq. potassa evaporated to solidity). Generally in hard sticks, run into moulds when in a liquid condition. *Colour*—White. An acrid corrosive; very deliquescent.

T. III.—**Chemistry**—*continued.*

Articles.	*Characteristics.*
"Potassa sulphurata" . . . . **Sulphidum potassicum.**	In tabular masses, generally broken up; a varying compound of potassium and sulphur. (Fig. 288.) *Fracture*—Yellowish brown. *Colour*—Greenish yellow. *Odour*—Very disagreeable; sulphurous. Yellow solution in water.
Potassium acetate . . . . $KC_2H_3O_2$. **Acetas potassicus.** (*Potassæ acetas.*)	Foliated mass, composed of shining scales, with a satin-like lustre. Preparation, as Sodium acetate. *Colour*—White. *Odour*—Slight. *Taste*—Saline. Its appearance is very characteristic.
Potassium bicarbonate. . . . $KHCO_3$. (Hydric potassium carbonate.) **Hydro-carbonas potassicum.** (*Potassæ bicarbonas.*)	In powder; or crystals, colourless, hard, opaque. Preparation, as Sodium bicarbonate. (Fig. 101.)
Potassium bichromate . . . $K_2Cr_2O_7$.	Crystals; transparent; four-sided. (Fig. 106.) *Colour*—Bright red, shining. Very stable in form and condition.
Potassium bromide . . . . KBr. **Bromidum potassicum.** (*Potassii bromidum.*)	Smaller crystals than iodide, more opaque, and the sides not so often excavated; more "compact" crystals. Prepared, as Iodide. (Fig. 93.)
Potassium carbonate . . . . K_2CO_3. **Carbonas potassicus.** (*Potassæ carbonas.*)	White crystalline powder. *Purified* pearl-ashes.
Potassium chlorate . . . . $KClO_3$. **Chloras potassicus.** (*Potassæ chloras.*)	Small scales, bright and glittering. Chlorine passed into a mixture of potassium carbonate and lime (slaked). (Fig. 103.) Colourless. *Taste*—Cool, saline.

	give
Potassium carbonate. K_2CO_3. Calcium hydrate (six molecules). $6CaH_2O_2$. Chlorine (six molecules) $6Cl_2$. (twelve atoms).	**Potassium chlorate** (two molecules). $\mathbf{2KClO_3}$. Calcium chloride (five molecules). $5CaCl_2$. Calcium carbonate. $CaCO_3$. Water (six molecules). $6H_2O$.

Potassium iodide . . . .
KI.
Iodidum (Ioduretum) potassicum.
(*Potassii iodidum.*)

An important and extensively-used compound of potassium. Prepared by dissolving iodine in caustic potash. (Fig. 100.)

Crystals—Cubic or quadrangular prisms. The angles of the cubes often remain distinct after the *sides* have entirely disappeared; hence they often appear *hollow*.
Colour—Opaque white.
Taste—Acrid; saline.

	give
(*a*) Iodine (three molecules) $3I_2$. (six atoms). Potassium hydrate (six molecules). $6HKO$.	**Potassium iodide** (five molecules). **5KI.** Water (three molecules). $3H_2O$.

	give
(*β*) Potassium iodate (two molecules). KIO_3 (or $2KIO_3$.) Heated with carbon (three molecules). $3C_2$.	**Potassium iodide** (two molecules). **2KI.** Carbonic oxide (six molecules). $6CO$.

Potassium nitrate . . . . .
KNO_3.
Nitras potassicus.
(*Potassæ nitras.*)

In masses of six-sided prisms, marked with fine parallel lines. Native saltpetre, crystallized. (Fig. 105.)

Colourless. Deflagrates on exposure to fire.

Potassium permanganate . . .
$KMnO_4$ (or $K_2Mn_2O_8$).
Permanganas potassicus.
(*Potassæ permanganas.*)

The theory of the formation of this salt is that, in the first part of the process, the manganese dioxide is oxidized by the potassium chlorate, and then unites with the potassium to form potassium manganate; on boiling with water, it splits up into a higher oxide of manganese and manganese dioxide. Minute crystals, prismatic. shining, and of slight metallic lustre. Readily parts with oxygen in presence of organic matter. (Fig. 285.)

Colour—Dark green and purple, forming a rich violet-red solution in water.

NON-METALLIC ELEMENTS.

Articles.	*Characteristics.*
1. *Carbon* . . . . C.	As C. animalis; and as C. ligni, from wood. In three allotropic forms—1. Diamond. 2. Graphite 3. Charcoal.
Carbonic dioxide. CO_2.	Calcium carbonate. $CaCO_3$. Hydrochloric acid (two molecules). 2HCl. give Calcium chloride. $CaCl_2$. **Carbonic-acid gas.** **CO_2.** Water. H_2O.
Carbonic oxide. CO.	
Marsh gas, or light carburetted hydrogen. CH_4.	
Olefiant gas, or heavy carburetted hydrogen. C_2H_4.	
Cyanogen . . . . CN.	A colourless gas, obtained by heating mercuric cyanide.
2. *Sulphur.* S.	
Sulphur (sublimed)	Fine but somewhat gritty powder; by microscope, small granules. Obtained by sublimation from rough sulphur. *Colour*—Bright lemon-yellow.
,, (precipitated) . . . . **Sulphur precipitatum.**	From the filtered water in which sulphur and lime have been boiled, the sulphur precipitated with hydrochloric acid, and well washed. Generally (of commerce) containing sulphate of lime; whitish yellow, soft and satiny; but if pure, light grey-yellow, and less soft in appearance. (Fig. 115.) *Odour*—*None* of sulphuretted hydrogen.

Sulphurous acid . . . . .
$H_2SO_3(SO_2+H_2O)$.
Acidum sulphurosum.

Colourless liquid. Sulphuric dioxide dissolved in water.
Odour—Pungent and sulphurous.

	give	
Copper (one molecule). Cu_2. Sulphuric acid (four molecules). $4H_2SO_4$.		Copper sulphate (two molecules). $2CuSO_4$. Water (four molecules). $4H_2O$. **Sulphuric dioxide** (two molecules). **$2SO_2$.** (In water it becomes H_2SO_3.)

Sulphuric acid . . . . . .
H_2SO_4.
Sulphuric trioxide in water.
$(SO_3+H_2O.)$
Acidum sulphuricum.

Thick oily liquid, almost twice the weight of water.
Colour—White.
Odourless. Acrid, most corrosive taste; violently corrosive in its action.

	give	
Sulphuric dioxide. SO_2. Water. H_2O. Nitric trioxide. N_2O_3.		**Sulphuric acid.** **H_2SO_4.** Nitric oxide. N_2O_2.

In the presence of water sulphuric dioxide takes an atom of oxygen from the nitric trioxide, which, becoming nitric oxide, takes up another atom of oxygen from the air, to be again given up to a second molecule of sulphuric dioxide.

Sulphuretted hydrogen, or hydrogen sulphide.
H_2S.

	give	
Ferrous (iron) sulphide. FeS. Sulphuric acid. H_2SO_4.		Ferrous (iron) sulphate. $FeSO_4$. **Hydrogen sulphide.** **H_2S.**

Articles.	*Characteristics.*
3. *Iodine* . . . . I. **Iodum.**	Preparation of iodine from "kelp" (ashes of seaweeds). Obtained by heating "kelp" with sulphuric acid and manganese dioxide. In crystalline scales, with metallic lustre; violet fumes, if heated. (Fig. 294.) *Colour*—Dark blue-black. *Odour*—Peculiar, resembling chlorine. *Taste*—Acrid. Gives blue colour with starch.

	give
Sodium iodide (two molecules). $2NaI$. Sulphuric acid (two molecules). $2H_2SO_4$. Manganese dioxide. MnO_2.	**Iodine** (one molecule) I_2. (two atoms). Sodium sulphate. Na_2SO_4. Manganese sulphate. $MnSO_4$. Water. $2H_2O$.

Hydriodic acid.
HI.

Iodic acid.
HIO_3.

Articles.	*Characteristics.*
4. *Chlorine* . . . . Cl.	Gas. Yellowish green; pungent. From sodium chloride, by the same decomposition as iodine. It has strong bleaching properties.
Hydrochloric acid . . . . HCl. **Acidum chlorhydricum.** (*Acidum hydrochloricum.*)	

	give
Sodium chloride. $NaCl$. Sulphuric acid. H_2SO_4.	**Hydrochloric acid.** HCl. Hydric-sodium sulphate. $NaHSO_4$.

Chlorous acid.
$HClO_2$.

Chloric acid.
$HClO_3$.

Perchloric acid.
$HClO_4$.

"Calx chlorata" . . . . . (Chlorinated lime.) **Hypochloris calcicus et Chloridum calcicum.**	A mixture of calcium chloride and calcium hypochlorite. Calcium hydrate (two molecules). $2CaH_2O_2$. Chlorine (two molecules) $2Cl_2$. (four atoms). give **Calcium chloride.** $CaCl_2$. **Calcium hypochlorite.** $CaCl_2O_2$. Water (two molecules). $2H_2O$.
5. *Bromine* . . . . . . Br. **Bromum.**	Thick oily liquid; volatile. Obtained as iodine. *Colour*—Deep red. *Odour*—Penetrating and disagreeable.
6. *Fluorine* . . . . . . F.	In fluorspar, or calcium fluoride.
Hydrofluoric acid . . . . HF.	From calcium fluoride by the action of sulphuric acid.
7. *Phosphorus* . . . . . . P.	Formed by treating powdered bone-dust with sulphuric acid, and heating the dried evaporated syrup with charcoal, when phosphorus distils. Solid mass, generally run in wedges or sticks; translucent, soft, wax-like; emitting white vapour on exposure, and becoming luminous in the dark. Found, as calcium phosphate, in bones of animals. *Colour*—White, turning to pink on the exterior by exposure. *Odour*—Peculiar, irritating. Phosphorus exists also in a red or amorphous condition, not inflammable below 260°.
Phosphorous acid. H_3PO_3.	
Phosphoric acid; or, when diluted . . . "Acidum phosphoricum dilutum." H_3PO_4.	Phosphorus (three molecules) $3P_2$. (six atoms). Nitric acid (ten molecules). $10HNO_3$. Water (four molecules). $4H_2O$. give **Phosphoric acid** (six molecules). $6H_3PO_4$. Nitric oxide (five molecules). $5N_2O_2$.

N.B.—There are several other "acid" compounds of phosphorus and oxygen.

Articles.	*Characteristics.*
8. *Boron* . . . . B.	As boracic acid in " borax "; from Tuscany and India.
Boracic acid. HBO_2+H_2O.	
Sodium borate . . . . . . $2NaBO_2, B_2O_3+10H_2O$. **Boras sodicus.** (*Sodæ boras.*)	Boracic acid neutralized by sodium carbonate. Crystals, generally of fair size; transparent, somewhat shining; soluble in water. (Fig. 110.) Colourless. *Taste*—Sweetish; styptic. **Tartras borico-potassicus,** soluble cream of tartar.
9. *Oxygen* . . . . O.	Gas; colourless, invisible, tasteless, odourless. [*Ozone*—nascent, active Oxygen.]
10. *Hydrogen.* H.	
Water. H_2O. **Aqua.**	
11. *Nitrogen.* . . . . N. [*Fr.* Azote.]	A colourless gas, constituting four-fifths of the atmosphere.
Nitric acid . . . . HNO_3. **Acidum nitricum.**	From potassium nitrate, by the action of sulphuric acid. Potassium nitrate KNO_3. Sulphuric acid. H_2SO_4. give | **Nitric acid.** HNO_3. Hydric potassium sulphate. $KHSO_4$.
Nitrous oxide (Laughing gas). N_2O.	

Nitric trioxide, under which are the nitrites, as Potassium nitrite [**Nitris potassicus**].
N_2O_3. KNO_2.

METALLIC ELEMENTS.

METALS OF THE ALKALIES.

1. *Sodium* . . . . . .
   Na.

A soft silver-white metal.

Sodium acetate.
$NaC_2H_3O_2, 3H_2O$.
Acetas sodicus.
(*Sodæ acetas.*)

Sodium carbonate. Na_2CO_3. Acetic acid (two molecules). $2HC_2H_3O_2$.	give	**Sodium acetate** (two molecules). $\mathbf{2NaC_2H_3O_2}$. Carbonic acid. CO_2. Water. H_2O.

(Fig. 284.)

Sodium arseniate . . . . . .
$Na_2HAsO_4, 7H_2O$.
Arsenias sodicus.
(*Sodæ arsenias.*)

In the method of preparation, arsenious acid is oxidized by the nitric acid in the sodium nitrate, and then, as arsenic acid, unites with the sodium, the nitric oxide and carbonic acid being driven off by the heat. (Fig. 289.)

Arsenious acid (three molecules). $3As_2O_3$. Sodium nitrate (four molecules). $4NaNO_3$. Sodium carbonate (four molecules). $4Na_2CO_3$. Water (three molecules). $3H_2O$.	give	**Sodium arseniate** (six molecules). $\mathbf{6Na_2HAsO_4}$. Nitric oxide (two molecules). $2N_2O_2$. Carbonic acid gas (four molecules). $4CO_2$.

Sodium chloride . . . . . .
NaCl.
Chloridum sodicum.
(*Sodii chloridum.*)

Common salt. In transparent cubic crystals, or white crystallized grains.

Sodium-potassium tartrate . . .
$NaKC_4H_4O_6$.

"Soda tartarata."
$NaKC_4H_4O_6 + 4H_2O$.
Tartras potassico-sodicus.

In crystals, but generally met with in powder; crystals, transparent prisms.
Colourless.
Taste—Milder than, but resembling, that of common salt.

Sodium carbonate (two molecules). Na_2CO_3. Hydric potassium tartrate. $2KHC_4H_4O_6$. (Cream of tartar.)	give	Water. H_2O. Carbonic-acid gas. CO_2. **Sodium-potassium tartrate.** $\mathbf{NaKC_4H_4O_6}$.

Articles.	*Characteristics.*
Sodium bicarbonate . . . . . $NaHCO_3$. (Hydric sodium carbonate.) **Hydro-carbonas sodicus.** (*Sodæ bicarbonas.*)	Crystalline scales, irregular; or more commonly as *powder*. **Sodium carbonate saturated with carbonic acid.** *Colour*—Opaque white. *Taste*—Pleasant saline. Sodium carbonate. Na_2CO_3. Carbonic acid. CO_2. Water. H_2O. give **Sodium bicarbonate.** **$2NaHCO_3$.** (Acid sodium carbonate or hydric sodium carbonate.)
Sodium carbonate . . . . . $Na_2CO_3+10H_2O$. ("Soda-ash.") **Carbonas sodicus.** (*Sodæ carbonas.*)	Crystals of a fair size, of a rhombic shape. From sodium chloride, by three processes. *Colour*—Transparent, colourless. *Taste*—Strongly alkaline. (*a*) Sodium chloride (two molecules). $2NaCl$. Sulphuric acid. H_2SO_4. give **Sodium sulphate.** **Na_2SO_4.** Hydrochloric acid (two molecules). $2HCl$. (*β*) Sodium sulphate. Na_2SO_4. Carbon (two molecules). $2C_2$. (four atoms.) give Carbonic oxide, free (four molecules). $4CO$. (*γ*) **Sodium sulphide.** **Na_2S.** Calcium carbonate. $CaCO_3$. give **Sodium carbonate.** **Na_2CO_3.** Calcium sulphide. CaS.
Sodium citro-tart. eff.	White granules; effervescing in water. (Fig. 185.)
Sodium hydrate . . . . . . $NaHO$. ("Soda caustica.") **Hydras sodicus.**	Calcium hydrate ("Lime") $Ca2HO$. Sodium carbonate. Na_2CO_3. give **Sodium hydrate** (two molecules). **$2NaHO$.** Calcium carbonate. $CaCO_3$.

Sodium nitrate . . . . . . $NaNO_3$. **Nitras sodicus.** (*Sodæ nitras.*)	From Chili (found native, in large beds).
Sodium phosphate . . . . $Na_2HPO_4,12H_2O$. (Hydric di-sodium phosphate.) **Phosphas sodicus.** (*Sodæ phosphas.*)	To a solution of acid calcium phosphate, obtained by treating bone-ash with sulphuric acid (when calcium sulphate remains), add sodium carbonate; sodium phosphate will crystallize out. (Fig. 111.) Acid calcium phosphate. CaH_42PO_4. Sodium carbonate (two molecules). $2Na_2CO_3$. give **Sodium phosphate** (two molecules). $\mathbf{2Na_2HPO_4}$. Water. H_2O. Carbonic-acid gas. CO_2. Calcium carbonate. $CaCO_3$.
Sodium sulphate . . . . . $Na_2SO_4+10H_2O$. **Sulphas sodicus.** (*Sodæ sulphas.*)	In oblique prisms. (Fig. 112.) *Colour*—Transparent white. *Taste*—Bitter. Hydric sodium sulphate ("Bisulphate") (two molecules). $2NaHSO_4$. Sodium carbonate. Na_2CO_3. give **Sodium sulphate** (two molecules). $\mathbf{2Na_2SO_4}$. Carbonic-acid gas. CO_2. Water. H_2O.
Sodium valerianate . . . . $NaC_5H_9O_2$. **Valeras sodicus.** (*Sodæ valerianas.*)	In masses; dry and amorphous; deliquescent. Fusel oil (amylic alcohol) is oxidized to valerianic acid by the action of potassium bichromate and sulphuric acid. This is then saturated with a solution of soda. (Fig. 286.) *Colour*—White. *Taste and Odour*—Of valerian.
2. *Potassium* . . . . K.	Soft silver-white metal.
Potassium hydrate . . . . KHO. ("Potassa caustica.") **Hydras potassicus.**	Or potassa fusa (liq. potassa evaporated to solidity). Generally in hard sticks, run into moulds when in a liquid condition. *Colour*—White. An acrid corrosive; very deliquescent.

Articles.	*Characteristics.*
"Potassa sulphurata" . . . . **Sulphidum potassicum.**	In tabular masses, generally broken up; a varying compound of potassium and sulphur. (Fig. 288.) *Fracture*—Yellowish brown. *Colour*—Greenish yellow. *Odour*—Very disagreeable; sulphurous. Yellow solution in water.
Potassium acetate . . . . . $KC_2H_3O_2$. **Acetas potassicus.** (*Potassæ acetas.*)	Foliated mass, composed of shining scales, with a satin-like lustre. Preparation, as Sodium acetate. *Colour*—White. *Odour*—Slight. *Taste*—Saline. Its appearance is very characteristic.
Potassium bicarbonate. . . . $KHCO_3$. (Hydric potassium carbonate.) **Hydro-carbonas potassicus.** (*Potassæ bicarbonas.*)	In powder; or crystals, colourless, hard, opaque. Preparation, as Sodium bicarbonate. (Fig. 101.)
Potassium bichromate . . . . $K_2Cr_2O_7$.	Crystals; transparent; four-sided. (Fig. 106.) *Colour*—Bright red, shining. Very stable in form and condition.
Potassium bromide . . . . . KBr. **Bromidum potassicum.** (*Potassii bromidum.*)	Smaller crystals than iodide, more opaque, and the sides not so often excavated; more "compact" crystals. Prepared, as Iodide. (Fig. 93.)
Potassium carbonate . . . . . K_2CO_3. **Carbonas potassicus.** (*Potassæ carbonas.*)	White crystalline powder. *Purified* pearl-ashes.
Potassium chlorate . . . . . $KClO_3$. **Chloras potassicus.** (*Potassæ chloras.*)	Small scales, bright and glittering. Chlorine passed into a mixture of potassium carbonate and lime (slaked). (Fig. 103.) Colourless. *Taste*—Cool, saline.

Potassium carbonate.
K_2CO_3.
Calcium hydrate (six molecules).
$6CaH_2O_2$.
Chlorine (six molecules)
$6Cl_2$. (twelve atoms).

give

Potassium chlorate (two molecules).
$2KClO_3$.
Calcium chloride (five molecules).
$5CaCl_2$.
Calcium carbonate.
$CaCO_3$.
Water (six molecules).
$6H_2O$.

Potassium iodide . . . . .
KI.
Iodidum (Ioduretum) potassicum.
(*Potassii iodidum.*)

An important and extensively-used compound of potassium. Prepared by dissolving iodine in caustic potash. (Fig. 100.)

Crystals—Cubic or quadrangular prisms. The angles of the cubes often remain distinct after the sides have entirely disappeared; hence they often appear *hollow*.
Colour—Opaque white.
Taste—Acrid; saline.

(*a*) Iodine (three molecules)
$3I_2$. (six atoms).
Potassium hydrate (six molecules).
6HKO.

give

Potassium iodide (five molecules).
5KI.
Water (three molecules).
$3H_2O$.

(*β*) Potassium iodate (two molecules).
KIO_3 (or $2KIO_3$.)
Heated with carbon (three molecules).
$3C_2$.

give

Potassium iodide (two molecules).
2KI.
Carbonic oxide (six molecules).
6CO.

Potassium nitrate . . . . .
KNO_3.
Nitras potassicus.
(*Potassæ nitras.*)

In masses of six-sided prisms, marked with fine parallel lines. Native saltpetre, crystallized. (Fig. 105.)

Colourless. Deflagrates on exposure to fire.

Potassium permanganate . . .
$KMnO_4$ (or $K_2Mn_2O_8$).
Permanganas potassicus.
(*Potassæ permanganas.*)

The theory of the formation of this salt is that, in the first part of the process, the manganese dioxide is oxidized by the potassium chlorate, and then unites with the potassium to form potassium manganate; on boiling with water, it splits up into a higher oxide of manganese and manganese dioxide. Minute crystals, prismatic. shining, and of slight metallic lustre. Readily parts with oxygen in presence of organic matter. (Fig. 285.)

Colour—Dark green and purple, forming a rich violet-red solution in water.

Articles.	*Characteristics.*
Potassium permanganate—*continued.*	(α) Potassium chlorate $KClO_3$. Potassium hydrate (six molecules). 6KHO. Manganese oxide (three molecules). $3MnO_2$. give Potassium chloride KCl. (β) Water (three molecules). $3H_2O$. **Potassium manganate** (three molecules) $3K_2MnO_4$. give Manganese dioxide. MnO_2. Potassium hydrate (four molecules). 4KHO. **Potassium permanganate** (two molecules). **$2KMnO_4$ ($K_2Mn_2O_8$).** Water. H_2O.
Potassium ferrocyanide . . . $K_4FeC_6N_6+3H_2O$. ("Potassæ prussias flava.") **Cyanuretum ferroso-potassicum.**	Massive tabular quadrangular crystals, with more or less truncated edges. Obtained from some animal substances, by fusing them in an iron vessel with potassium carbonate. (Fig. 107.) *Colour*—Bright lemon-yellow; transparent. Odourless. *Taste*—Cool, saline.
Potassium ferridcyanide . . . $K_6Fe_2C_{12}N_{12}$. ("Potassæ prussas rubra.") **Cyanuretum ferrico-potassicum.**	Dark red prisms. (Fig. 108.)
Potassium sulphate . . . . K_2SO_4. **Sulphas potassicus.** (*Potassæ sulphas.*)	In hard small six-sided prisms, terminating in six-sided pyramids. Prepared from acid potassium sulphate, a bye product in the manufacture of nitric acid. Colourless.
Hydric potassium tartrate . . $KHC_4H_4O_6$. (Acid potassium tartrate, "cream of tartar." "Potassæ bitartras.") **Hydro-tartras potassicus.** (*Potassæ tartras acida.*)	Crystalline irregular masses, hard and gritty; or in impalpable powder. Obtained from crude tartar, deposited during the fermentation of grape-juice. (Fig. 99.) *Colour*—White. *Taste*—Agreeably acid.

Potassium citrate $K_3C_6H_5O_7$. **Citras potassicus.** (*Potassæ citras.*)	A white deliquescent powder, with feeble acid taste. Formation, as Potassium acetate.
Potassium tartrate $K_2C_4H_4O_6$. **Tartras potassicus.** (*Potassæ tartras.*)	Formation, as Potassium acetate.
3. *Ammonium* NH_4.	A hypothetical metal.
Ammonia NH_3.	Gas, strong smelling. In solution it forms the "Liq. ammon. fort," sp. gr. ·880.
Ammonium oxide (hypothetical). NH_4O.	
Ammonium benzoate $NH_4C_7H_5O_2$. **Benzoas ammonicus.** (*Ammoniæ benzoas.*)	Crystalline plates; soluble; colourless. Crystallized from ammonia saturated with benzoic acid. (Fig. 267.)
Ammonium cromide	(Fig. 269.)
Ammonium carbonate $N_4H_{16}C_3O_8$. **Carbonas ammonicus.** (*Ammoniæ carbonas.*)	From the sublimation of a mixture of ammonium chloride and calcium carbonate. In semi-opaque crystalline masses. *Colour*—White where not translucent. *Odour*—Strong, ammoniacal. *Taste*—Pungent. Ammonium chloride (six molecules). $6NH_4Cl$. Calcium carbonate (three molecules). $3CaCO_3$. give **Ammonium carbonate.** $N_4H_{16}C_3O_8$. Calcium chloride (three molecules). $3CaCl_2$. Water. H_2O. Ammonia gas (two molecules). $2NH_3$.
Ammonium phosphate $(NH_4)_2HPO_4$. **Phosphas ammonicus.** (*Ammoniæ phosphas.*)	In transparent prisms, produced by adding ammonia to phosphoric acid. (Fig. 268.)

SECT. III.—**Chemistry**—*continued.*

Articles.	*Characteristics.*
Ammonium chloride . . . . NH_4Cl. **Chloridum ammonicum.** (*Ammonii chloridum.*)	Formed by neutralizing hydrochloric acid with ammonia, with subsequent sublimation. The Ammoniæ hydrochloras of B.P., 1864. In translucent, tough, fibrous masses. Devoid of colour or odour.

Ammonium acetate (liquor) and ammonium citrate (liquor) are produced by saturating the respective acids with ammonium carbonate.
Acetas ammonicus.

4. *Lithium.*
L.

Lithium carbonate . . . . . L_2CO_3. **Carbonas lithicus.** (*Lithiæ carbonas.*)	In small crystalline grains, or in powder. (Fig. 282.) *Colour*—White, but it imparts a red colour to flame.
Lithium citrate . . . . . . $L_3C_6H_5O_7$. **Citras lithicus.** (*Lithiæ citras.*)	White, amorphous, deliquescent powder; soluble in water. Formed by adding the carbonate to a citric-acid solution, with liberation of carbonic acid, and formation of the new compound.

II. METALS OF THE ALKALINE EARTHS.

1. *Calcium.*
Ca.

Calcium oxide . . . . . . CaO. ("Calx.") **Oxidum calcicum.**	The alkaline earth (lime) of the metal *Calcium.* Yellowish white masses; hard, becoming friable when, by the addition of water, it has become hydrated, forming "*Calcii hydras*" Obtained by driving off the carbonic-acid gas from chalk or marble ($CaCO_3$).
Calcium hydrate. CaH_2O_2. **Hydras calcicus.** (*Calx hydrata.*)	
"Calx chlorata" . . . . . $Ca_2Cl_4O_2$. **Hypochloris calcicus et Chloridum calcicum.**	A mixture of calcium chloride ($CaCl_2$) and calcium hypochlorite ($CaCl_2O_2$). Soft powder, slightly damp. From the action of chlorine on moist slaked lime. *Colour*—Dull white. *Odour*—Strongly impregnated with chlorine.

[See page 118.]

Calcium chloride . . . . . .
$CaCl_2$.
Chloridum calcicum.
(*Calcii chloridum.*)

In agglutinated masses, light, dry, hard, and friable: very deliquescent.
Colourless; slightly translucent.

Calcium carbonate.
$CaCO_3$.
Hydrochloric acid (two molecules).
$2HCl$.
give
Calcium chloride.
$CaCl_2$.
Water.
H_2O.
Carbonic dioxide.
CO_2.

Calcium carbonate . . . .
$CaCO_3$.
("Calcis carbonas precipitata.")
Carbonas calcicus.

Calcium chloride.
$CaCl_2$.
Sodium carbonate.
Na_2CO_3.
give
Calcium carbonate.
$CaCO_3$.
Sodium chloride (two molecules).
$2NaCl$.

Calcium phosphate . . . . .
Ca_32PO_4.
Phosphas calcicus.
(*Calcii phosphas.*)

Tri-calcium phosphate. Occurs in bones, &c. Dissolved out (as acid phosphate) with hydrochloric acid, and reprecipitated as a white insoluble powder by ammonia.

2. *Strontium.*
Sr.

Strontium nitrate . . . . .
$Sr2NO_3$.
Nitras stronticus.
(*Strontii nitras.*)

Obtained from the carbonate; used to colour flame crimson.

3. *Barium.*
Ba.

Barium chloride . . . . . .
$BaCl_2$.

From the solution in hydrochloric acid of the native carbonate. The nitrate imparts to flame a green colour.

III. METALS OF THE EARTHS.

1. *Aluminium* . . . . . .
Al.

A white metal. Alumina (Al_2O_3) is the oxide.

Aluminium-ammonium sulphate . .
$AlNH_4(SO_4)_2+12HO$.
("Alumen.")
Sulphas aluminico-ammonicus.

In crystalline blocks, often of large size. To aluminium sulphate (produced by decomposition of an aluminous shale) is added ammonium sulphate (or ammonia liquor and sulphuric acid), and the two crystallized together.
Colourless; transparent.
Taste—Strongly astringent (partly acid, partly sweet).

Articles.	*Characteristics.*
"Alumen exsiccatum" . . .	Spongiform, friable, white mass. Ordinary alum with the water of crystallization driven off.
2. *Cerium.* Ce.	
Cerium oxalate . . . . . . $CeC_2O_4+3H_2O$. **Oxalas cericus.** (*Cerii oxalas.*)	A white *granular* powder; decomposed by heat into reddish brown oxide. Obtained by adding ammonium oxalate to a soluble salt of cerium. (Fig. 274.)
IV. METALS PROPER.	
(α) **Zinc Class.**	
1. *Zinc.* Zn.	
"Zincum granulatum" . . .	The fused metal poured from a height into water. (Fig. 296.)
Zinc acetate . . . . . $Zn(C_2H_3O_2)_2+2H_2O$. **Acetas zincicus.** (*Zinci acetas.*)	Thin, silky, laminar crystals. (Fig. 104.) *Colour*—Pearl-white. *Taste*—Sharp metallic. Zinc oxycarbonate. $ZnCO_3(ZnO)_2 3H_2O$. Acetic acid (six molecules). $6HC_2H_3O_2$. give **Zinc acetate** (three molecules). $3Zn(C_2H_3O_2)_2$. Water (six molecules). $6H_2O$. Carbonic-acid gas. CO_2.
Zinc chloride . . . . $ZnCl_2$. **Chloridum zincicum.** (*Zinci chloridum.*)	Fused and run into *pencils*, or tabular plates; very deliquescent. Zinc dissolved in HCl. *Colour*—White; opaque. Strong caustic. Zinc. Zn_2. Hydrochloric acid (four molecules). $4HCl$. give **Zinc chloride** (two molecules). $2ZnCl_2$. Hydrogen, free (two molecules). $2H_2$.

Zinc oxide . . . . ZnO. **Oxidum zincicum.** (*Zinci oxidum.*)	Soft, velvety powder; on exposure to heat, assumes a pale yellow colour. Obtained by driving the water and carbonic acid from ordinary zinc carbonate. *Colour*—Yellowish white, or nearly white. Odourless and tasteless.
Zinc sulphate . . . . . . $ZnSO_4+7H_2O$. **Sulphas zincicus.** (*Zinci sulphas.*)	Zinc carbonate and solution of chlorine are here (also in "Liquor zinci chloridi," &c.) made use of to remove iron and lead that may exist in the metallic zinc. Small, delicate, transparent prisms; much resembles "Magnesiæ sulphas." Prepared by boiling zinc with sulphuric acid and water. (Fig. 114.) Colourless; somewhat shining. *Taste*—Metallic styptic.
Zinc valerianate . . . . . . $Zn(C_5H_9O_2)_2$. **Valeras zincicus.** (*Zinci valerianas.*)	Minute crystals in a tabular arrangement, apparently in powder, or in flaky scales. By double decomposition, or interchange, between zinc sulphate and sodium valerianate. (Fig. 287.) *Colour*—Pearly white. *Odour*—Distinct of valerian.
Zinc carbonate . . . . . . $ZnCO_3(ZnO)_23H_2O$. (Zinc oxycarbonate.) **Carbonas zincicus.** (*Zinci carbonas.*)	A mixture of carbonate and oxide of zinc. Zinc carbonate occurs in a native state (calamine), but that which is precipitated by an alkali (here by sodium carbonate) contains always much oxide. The theory of this formation is similar to that of Magnesium carbonate, noticed below.
2. *Magnesium* . . . . **Mg.**	Softish white metal.
Magnesium carbonate	Concentrated solution (in hot). Powder, minutely granular.
Magnesium ,, "levis" . .	Less concentrated solution (in cold). Powder, excessively light and flocculent; partly (under microscope) amorphous, partly very minute prisms. *Colour*—White. Odourless and tasteless
(Magnesium oxycarbonate) . . $(MgCO_3)_3MgO, 5H_2O$. **Hydro-carbonas magnesicus.** (*Magnesiæ carbonas.*)	These are two forms of the same article, which is a varying mixture of carbonate and hydrate; for with the carbonate (as is the case with the similar zinc salt) is precipitated a certain amount of hydrate.

	give
Magnesium sulphate (four molecules). $4MgSO_4$.	**Magnesium carbonate.** $(MgCO_3)_3MgO, 5H_2O$.
Sodium carbonate (four molecules). $4Na_2CO_3$.	Sodium sulphate (four molecules). $4Na_2SO_4$.
Water (five molecules). $5H_2O$.	Carbonic-acid gas. CO_2.

Though insoluble in water, it is soluble in a solution of carbonic acid. This forms the "Liquor magnesiæ carbonatis."

Articles.	*Characteristics.*
("Magnesia") Magnesium oxide. MgO. **Oxidum magnesicum.** (*Magnesiæ oxidum.*)	Powder; rather dense, usually termed "heavy calcined." By depriving the heavy carbonate of its carbonic acid by incineration. *Colour*—White. Insoluble in water. By keeping, absorbs carbonic acid from the atmosphere.
"Magnesia levis"	"Light calcined magnesia." From the light carbonate.
Magnesium sulphate $MgSO + 7H_2O$. **Sulphas magnesicus.** (*Magnesiæ sulphas.*)	Rhombic prisms; in long acicular crystals. From magnesium limestone (carbonate), by removing the lime with sulphuric acid, part of which unites with the magnesia, liberating carbonic-acid gas. (Fig. 97.) Colourless; often damp; sparkling. *Taste*—Saline-bitter, nauseous.
3. *Cadmium.*	
Cadmium iodide CdI. **Iodidum cadmicum.** (*Cadmii iodidum.*)	In foliaceous crystalline plates, with pearly lustre. Direct combination of the two elements, in the presence of water. (Fig. 137.) *Colour*—White, with cream-coloured tinge.
(β) **Iron Class.**	
1. *Ferrum* Fe.	Iron wire or nails free from oxide. (Fig. 292.) Oxides—Four. FeO. Monoxide, or *ferrous* oxide, giving green salts. Fe_2O_3. Sesquioxide, or *ferric* oxide, giving yellow salts. Fe_3O_4. Magnetic oxide [**Oxidum ferroso-ferricum**]. (Fig. 277.) H_2FeO_4. Ferric acid. N.B.—In the nomenclature of the series of Iron salts, we prefer the adjectives *ferrous* and *ferric* to the simple name of the metal. Their use respectively denotes whether the salt comes under the type of the monoxide or of the sesquioxide: the termination in *ic* denoting the higher oxide. The same rule applies to all metals the oxides of which furnish more than one series of salts; as mercury, copper, tin, &c.
"Ferrum tartaratum" Ferri potassio-tartras. **Tartras ferrico-potassicus.**	Scales, thin and transparent, dry, shining, brittle, breaking in irregular-sized pieces, with acute edges. Ferric oxide is here rendered soluble by forming, with acid potassium tartrate, a double tartrate. *Colour*—Deep garnet-red. Odourless. *Taste*—Styptic.

"Ferrum redactum"	Metallic iron, with small variable percentage of oxide of iron (magnetic). Fine powder; attracted by magnet. From the peroxide; reduced by hydrogen removing the oxygen from it, when in a heated condition. (Fig. 292.) *Colour*—Greyish black.
Ferrous arseniate . . . . $Fe_3As_2O_8$ (partially oxidized). **Arsenias ferrosus.** (*Ferri arsenias.*)	Amorphous, smooth powder. The white precipitate arising from the double decomposition between sodium arseniate and ferrous sulphate. (Fig. 275.) *Colour*—Green. Tasteless.
" Ferri carbonas saccharata " . .	Small, amorphous, coherent, pulverulent nodules. Ferrous carbonate mixed with ferric oxide and sugar, the carbonate forming at least 57 per cent. (Fig. 94.) *Colour*—Grey; as light as possible. *Taste*—Feebly of iron; sweetish.
Ferrous carbonate . . . . $FeCO_3$. **Carbonas ferrosus.** (*Ferri carbonas.*)	Ferrous sulphate. $FeSO_4$. Ammonium carbonate. $(NH_4)_2CO_3$. give **Ferrous carbonate.** $FeCO_3$. Ammonium sulphate. $(NH_4)_2SO_4$.
"Ferri et ammoniæ citras". . . . Ammonium ferric citrate **Citras ammonico-ferricus.**	Scales, thin and transparent; shining, brittle; soluble in water. A double citrate of iron and ammonium. The ferric oxide, precipitated from a solution of persulphate by ammonia, is dissolved in citric acid (forming a citrate); to this is added ammonia; then evaporated and *scaled*. (Fig. 170.) *Colour*—Deep ruby-red. *Taste*—Astringent.
"Ferri et quiniæ citras" . . . Quinia ferric citrate	Scales, as above, but more brilliant and sparkling. Dissolve ferric oxide and quinia in citric acid solution, add ammonia, and then, after evaporation, scale. (Fig. 169.) *Colour*—Golden yellow, with a tinge of green. *Taste*—The bitter of the quinine and the chalybeate of the iron.
Ferrous iodide . . . . . . FeI_2. **Iodidum ferrosum.** (*Ferri iodidum.*)	This contains about 18 per cent. water of crystallization and a little iron oxide. Direct contact of the two elements in water, with heat, and subsequent evaporation to solid condition. In tabular masses or thin cakes, with metallic crystalline structure. Deliquescent. (Fig. 276.) *Colour*—Chocolate-brown, with sometimes a green tint; forms a greenish solution, turning brown-red.
" Ferri oxidum magneticum " . . Fe_3O_4 (Magnetic iron oxide.) **Oxidum ferroso-ferricum.**	Powder; magnetic to a high degree. A mixture of ferrous and ferric oxides; black oxide of iron, in a hydrated state. *Colour*—Brown-greyish black. Tasteless.

Articles.	*Characteristics.*
"Potassa sulphurata" . . . . **Sulphidum potassicum.**	In tabular masses, generally broken up; a varying compound of potassium and sulphur. (Fig. 288.) *Fracture*—Yellowish brown. *Colour*—Greenish yellow. *Odour*—Very disagreeable; sulphurous. Yellow solution in water.
Potassium acetate . . . . . $KC_2H_3O_2$. **Acetas potassicus.** (*Potassæ acetas.*)	Foliated mass, composed of shining scales, with a satin-like lustre. **Preparation, as** Sodium acetate. *Colour*—White. *Odour*—Slight. *Taste*—Saline. Its appearance is very characteristic.
Potassium bicarbonate. . . . . $KHCO_3$. (Hydric potassium carbonate.) **Hydro-carbonas potassicus.** (*Potassæ bicarbonas.*)	In powder; or crystals, colourless, hard, opaque. Preparation, as Sodium bicarbonate. (Fig. 101.)
Potassium bichromate . . . . $K_2Cr_2O_7$.	Crystals; transparent; four-sided. (Fig. 106.) *Colour*—Bright red, shining. Very stable in form and condition.
Potassium bromide . . . . . KBr. **Bromidum potassicum.** (*Potassii bromidum.*)	Smaller crystals than iodide, more opaque, and the sides not so often excavated; more "compact" crystals. Prepared, as Iodide. (Fig. 93.)
Potassium carbonate . . . . . K_2CO_3. **Carbonas potassicus.** (*Potassæ carbonas.*)	White crystalline powder. *Purified* pearl-ashes.
Potassium chlorate . . . . . $KClO_3$. **Chloras potassicus.** (*Potassæ chloras.*)	Small scales, bright and glittering. Chlorine passed into a mixture of potassium carbonate and lime (slaked). (Fig. 103.) Colourless. *Taste*—Cool, saline.

Potassium carbonate.
K_2CO_3.
Calcium hydrate (six molecules).
$6CaH_2O_2$.
Chlorine (six molecules)
$6Cl_2$. (twelve atoms).

give

Potassium chlorate (two molecules).
$2KClO_3$.
Calcium chloride (five molecules).
$5CaCl_2$.
Calcium carbonate.
$CaCO_3$.
Water (six molecules).
$6H_2O$.

Potassium iodide . . . .
KI.
Iodidum (Ioduretum) potassicum.
(*Potassii iodidum.*)

An important and extensively-used compound of potassium. Prepared by dissolving iodine in caustic potash. (Fig. 100.)

Crystals—Cubic or quadrangular prisms. The angles of the cubes often remain distinct after the *sides* have entirely disappeared; hence they often appear *hollow*.
Colour—Opaque white.
Taste—Acrid; saline.

(*α*) Iodine (three molecules)
$3I_2$. (six atoms).
Potassium hydrate (six molecules).
6HKO.

give

Potassium iodide (five molecules).
5KI.
Water (three molecules).
$3H_2O$.

(*β*) Potassium iodate (two molecules).
KIO_3 (or $2KIO_3$.)
Heated with carbon (three molecules).
$3C_2$.

give

Potassium iodide (two molecules).
2KI.
Carbonic oxide (six molecules).
6CO.

Potassium nitrate . . . .
KNO_3.
Nitras potassicus.
(*Potassæ nitras.*)

In masses of six-sided prisms, marked with fine parallel lines. Native saltpetre, crystallized. (Fig. 105.)

Colourless. Deflagrates on exposure to fire.

Potassium permanganate . . .
$KMnO_4$ (or $K_2Mn_2O_8$).
Permanganas potassicus.
(*Potassæ permanganas.*)

The theory of the formation of this salt is that, in the first part of the process, the manganese dioxide is oxidized by the potassium chlorate, and then unites with the potassium to form potassium manganate; on boiling with water, it splits up into a higher oxide of manganese and manganese dioxide. Minute crystals, prismatic. shining, and of slight metallic lustre. Readily parts with oxygen in presence of organic matter. (Fig. 285.)

Colour—Dark green and purple, forming a rich violet-red solution in water.

Articles.	*Characteristics.*
Potassium permanganate—*continued.*	(α) Potassium chlorate $KClO_3$. Potassium hydrate (six molecules). $6KHO$. Manganese oxide (three molecules). $3MnO_2$. give Potassium chloride KCl. (β) Water (three molecules). $3H_2O$. **Potassium manganate** (three molecules) $3K_2MnO_4$. give **Manganese dioxide.** MnO_2. Potassium hydrate (four molecules). $4KHO$. **Potassium permanganate** (two molecules). $\mathbf{2KMnO_4\ (K_2Mn_2O_8)}$. Water. H_2O.
Potassium ferrocyanide . . . . $K_4FeC_6N_6+3H_2O$. ("Potassæ prussias flava.") **Cyanuretum ferroso-potassicum.**	Massive tabular quadrangular crystals, with more or less truncated edges. Obtained from some animal substances, by fusing them in an iron vessel with potassium carbonate. (Fig. 107.) *Colour*—Bright lemon-yellow; transparent. Odourless. *Taste*—Cool, saline.
Potassium ferridcyanide . . . . $K_6Fe_2C_{12}N_{12}$. ("Potassæ prussas rubra.") **Cyanuretum ferrico-potassicum.**	Dark red prisms. (Fig. 108.)
Potassium sulphate . . . . . K_2SO_4. **Sulphas potassicus.** (*Potassæ sulphas.*)	In hard small six-sided prisms, terminating in six-sided pyramids. Prepared from acid potassium sulphate, a bye product in the manufacture of nitric acid. Colourless.
Hydric potassium tartrate . . $KHC_4H_4O_6$. (Acid potassium tartrate, "cream of tartar." "Potassæ bitartras.") **Hydro-tartras potassicus.** (*Potassæ tartras acida.*)	Crystalline irregular masses, hard and gritty; or in impalpable powder. Obtained from crude tartar, deposited during the fermentation of grape-juice. (Fig. 99.) *Colour*—White. *Taste*—Agreeably acid.

Potassium citrate . . . . . $K_3C_6H_5O_7$. **Citras potassicus.** (*Potassæ citras.*)	A white deliquescent powder, with feeble acid taste. Formation, as Potassium acetate.
Potassium tartrate . . . . . $K_2C_4H_4O_6$. **Tartras potassicus.** (*Potassæ tartras.*)	Formation, as Potassium acetate.
3. *Ammonium* . . . . . . NH_4.	A hypothetical metal.
Ammonia . . . . NH_3.	Gas, strong smelling. In solution it forms the "Liq. ammon. fort," sp. gr. ·880.
Ammonium oxide (hypothetical). NH_4O.	
Ammonium benzoate . . . . . $NH_4C_7H_5O_2$. **Benzoas ammonicus.** (*Ammoniæ benzoas.*)	Crystalline plates; soluble; colourless. Crystallized from ammonia saturated with benzoic acid. (Fig. 267.)
Ammonium cromide	. . . . (Fig. 269.)
Ammonium carbonate . . . . . $N_4H_{16}C_3O_8$. **Carbonas ammonicus.** (*Ammoniæ carbonas.*)	From the sublimation of a mixture of ammonium chloride and calcium carbonate. In semi-opaque crystalline masses. *Colour*—White where not translucent. *Odour*—Strong, ammoniacal. *Taste*—Pungent. Ammonium chloride (six molecules). $6NH_4Cl$. Calcium carbonate (three molecules). $3CaCO_3$. give **Ammonium carbonate.** $N_4H_{16}C_3O_8$. Calcium chloride (three molecules). $3CaCl_2$. Water. H_2O. Ammonia gas (two molecules). $2NH_3$.
Ammonium phosphate . . . $(NH_4)_2HPO_4$. **Phosphas ammonicus.** (*Ammoniæ phosphas.*)	In transparent prisms, produced by adding ammonia to phosphoric acid. (Fig. 268.)

Articles.	*Characteristics.*
Ammonium chloride . . . . . NH_4Cl. **Chloridum ammonicum.** (*Ammonii chloridum.*)	Formed by neutralizing hydrochloric acid with ammonia, with subsequent sublimation. The Ammoniæ hydrochloras of B.P., 1864. In translucent, tough, fibrous masses. Devoid of colour or odour.

Ammonium acetate (liquor) and ammonium citrate (liquor) are produced by saturating the respective acids with ammonium carbonate.
Acetas ammonicus.

4. *Lithium.*
L.

Lithium carbonate . . . . . L_2CO_3. **Carbonas lithicus.** (*Lithiæ carbonas.*)	In small crystalline grains, or in powder. (Fig. 282.) *Colour*—White, but it imparts a red colour to flame.
Lithium citrate . . . . . . $L_3C_6H_5O_7$. **Citras lithicus.** (*Lithiæ citras.*)	White, amorphous, deliquescent powder; soluble in water. Formed by adding the carbonate to a citric-acid solution, with liberation of carbonic acid, and formation of the new compound.

II. METALS OF THE ALKALINE EARTHS.

1. *Calcium.*
Ca.

Calcium oxide . . . . . . CaO. ("Calx.") **Oxidum calcicum.**	The alkaline earth (lime) of the metal *Calcium*. Yellowish white masses; hard, becoming friable when, by the addition of water, it has become hydrated, forming "*Calcii hydras*" Obtained by driving off the carbonic-acid gas from chalk or marble ($CaCO_3$).
Calcium hydrate. CaH_2O_2. **Hydras calcicus.** (*Calx hydrata.*)	
"Calx chlorata" . . . . . $Ca_2Cl_4O_2$. **Hypochloris calcicus et Chloridum calcicum.**	A mixture of calcium chloride ($CaCl_2$) and calcium hypochlorite ($CaCl_2O_2$). Soft powder, slightly damp. From the action of chlorine on moist slaked lime. *Colour*—Dull white. *Odour*—Strongly impregnated with chlorine.

[See page 118.]

Calcium chloride . . . . . . $CaCl_2$. **Chloridum calcicum.** (*Calcii chloridum.*)	In agglutinated masses, light, dry, hard, and friable: very deliquescent. Colourless; slightly translucent. Calcium carbonate. $CaCO_3$. Hydrochloric acid (two molecules). $2HCl$. give **Calcium chloride.** $\mathbf{CaCl_2}$. Water. H_2O. Carbonic dioxide. CO_2.
Calcium carbonate . . . . $CaCO_3$. ("Calcis carbonas precipitata.") **Carbonas calcicus.**	Calcium chloride. $CaCl_2$. Sodium carbonate. Na_2CO_3. give **Calcium carbonate.** $\mathbf{CaCO_3}$. Sodium chloride (two molecules). $2NaCl$.
Calcium phosphate . . . . . Ca_32PO_4. **Phosphas calcicus.** (*Calcii phosphas.*)	Tri-calcium phosphate. Occurs in bones, &c. Dissolved out (as acid phosphate) with hydrochloric acid, and reprecipitated as a white insoluble powder by ammonia.
2. *Strontium.* Sr.	
Strontium nitrate . . . . . $Sr2NO_3$. **Nitras stronticus.** (*Strontii nitras.*)	Obtained from the carbonate; used to colour flame crimson.
3. *Barium.* Ba.	
Barium chloride . . . . . . $BaCl_2$.	From the solution in hydrochloric acid of the native carbonate. The nitrate imparts to flame a green colour.
III. METALS OF THE EARTHS.	
1. *Aluminium* . . . . . . Al.	A white metal. Alumina (Al_2O_3) is the oxide.
Aluminium-ammonium sulphate . . $AlNH_4(SO_4)_2+12HO$. ("Alumen.") **Sulphas aluminico-ammonicus.**	In crystalline blocks, often of large size. To aluminium sulphate (produced by decomposition of an aluminous shale) is added ammonium sulphate (or ammonia liquor and sulphuric acid), and the two crystallized together. Colourless; transparent. *Taste*—Strongly astringent (partly acid, partly sweet).

Articles.	*Characteristics.*
Silver chloride . . . . . . $AgCl$. **Chloridum argenticum.** (*Argenti chloridum.*)	White horny mass, blackening with light; soluble in ammonia.
Silver nitrate . . . . $AgNO_3$. **Nitras argenticum.** (*Argenti nitras*).	In tabular transparent crystals, or fused in sticks, at first white, but rapidly acquiring a blue-black colour. Silver dissolved in nitric acid (dilute), giving off nitric oxide (NO). *Crystals*—Devoid of colour or smell; blackens (suboxide) with light. *Taste*—Metallic bitter. *Pencils*—Blackish in colour, and fuses with heat.
Silver oxide . . . . . . Ag_2O. **Oxidum argenticum.** (*Argenti oxidum.*)	Olive-brown powder. Silver nitrate (two molecules). $2AgNO_3$. Calcium oxide (lime, in solution). CaO. give **Silver oxide.** **Ag_2O.** Calcium nitrate. $Ca2NO_3$.
3. *Hydrargyrum* . . . . . . Hg.	Mercury. Fluid at ordinary temperatures, and with lustrous metallic reflection. (Fig. 293.) Two oxides— Mercurous or black oxide. Hg_2O. Formed when an alkali removes the chlorine from the subchloride (calomel), or mercurous chloride. **Oxidum mercurosum.** Mercuric or red oxide. HgO. Formed by heating mercuric nitrate. **Oxidum mercuricum.**
Mercuric ammonium chloride . . . "Hydrargyrum ammoniatum." NH_2HgCl.	Heavy powder, or in masses easily reduced to powder; insoluble in water and in alcohol. *Colour*—Opaque white, of a creamy tinge. Odourless. *Taste*—Metallic. Mercury perchloride (mercuric chloride). $HgCl_2$. Ammonium hydrate (two molecules). (ammonia). $2NH_4HO$. give **Mercuric ammonium chloride.** **NH_2HgCl.** Ammonium. chloride. NH_4Cl. Water (two molecules). $2H_2O$.

"Hydrargyrum c. cretâ" . . .

Powder; light grey, not gritty (though rare to find it completely smooth). "Grey powder."

Mercuric iodide . . . . . .
HgI_2.
Iodidum mercuricum.
(*Hydrargyri iodidum rubrum.*)

Semi-crystalline (with microscope) powder; heavy and dense. (Fig. 279.)
Colour—Brilliant scarlet; rendered yellow by heat cautiously applied.

give

Mercury perchloride (mercuric chloride). $HgCl_2$. Potassium iodide (two molecules). 2KI.	**Mercury periodide** (mercuric iodide). **HgI_2.** Potassium chloride (two molecules). 2KCl.

Mercurous iodide . . . . .
HgI.
Iodidum mercurosum.
(*Hydrargyri iodidum viride.*

Powder; dull yellowish green, darkening on exposure. Simple combination of the two elements, in the ratio of their respective atomic weights.

Mercuric oxide . . . . . .
HgO.
Oxidum mercuricum.
(*Hydrargyri oxidum rubrum.*)

Powder; having the appearance of crystalline scales; very heavy. From the nitrate ($Hg2NO_3$) by driving off the $2NO_3$. (Fig. 96.)
Colour—Orange-red.

Mercuric chloride (mercury perchloride)
$HgCl_2$.
Chloridum mercuricum.
(*Hydrargyri perchloridum.*)

Corrosive sublimate. In semi-transparent masses of prismatic crystals.
Colourless and odourless.
Acrid taste; violently poisonous.

give

Mercuric sulphate. $HgSO_4$. Sodium chloride (two molecules). 2NaCl.	**Mercury perchloride** (mercuric chloride). **$HgCl_2$.** Sodium sulphate. Na_2SO_4.

Mercurous chloride (mercury subchloride)
HgCl.(Hg_2Cl_2).
Chloridum mercurosum.
(*Hydrargyri subchloridum.*)

Calomel. Heavy powder; soft and velvety; becomes yellow if rubbed up for some time.
Opaque white, of a creamy tinge.
Odourless.
Nearly tasteless. Insoluble in water, spirit, or ether.

give

(*a*) Mercury subsulphate (mercurous sulphate). Hg_2SO_4. Sodium chloride (two molecules). 2NaCl.	**Mercury subchloride** (mercurous chloride). **Hg_2Cl_2.** (HgCl). Sodium sulphate. Na_4SO_4.

[N.B. Mercurous sulphate (Hg_2SO_4) is formed by triturating mercuric sulphate ($HgSO_4$) and mercury.]

Articles.	*Characteristics.*
Mercurous chloride—*continued.*	(β) Or by another process, by sublimation:— Mercury. Hg. Mercuric chloride. $HgCl_2$. give **Mercurous chloride.** **Hg_2Cl_2.**
Mercuric sulphate . . . . . $HgSO_4$. **Sulphas mercuricus.** (*Hydrargyri sulphas.*)	Mercury dissolved in sulphuric acid. (Fig. 280.)
Mercuric nitrate . . . . . . $Hg2NO_3$. **Nitras mercuricus.** (*Hydrargyri pernitras.*)	The metal dissolved in *strong* nitric acid, with subsequent heat. The "liquor."
Mercuric sulphide . . . . . HgS.	Precipitated, black; sublimed, red: Cinnabar or vermilion.
4. *Plumbum* . . . . Pb.	Lead.
Lead oxide . . . . PbO. **Oxidum plumbicum.** (*Plumbi oxidum.*)	PbO. Litharge ("Massicot," if in yellow powder); scales; having a quasi-crystalline structure; very dense. From the metal, heated in a current of air. (Fig. 291.) *Colour*—Pale brick-red. PbO_2. Puce-coloured oxide (or dioxide). Pb_2O_3. Red lead; a mixture of the two preceding.
Lead acetate . . . . . . $Pb(C_2H_3O_2)_2+3H_2O$. (For "Plumbi subacetas," see "Liquores.") **Acetas plumbicus.** (*Plumbi acetas.*)	Generally in agglomerated masses of minute and brilliant acicular crystals; resembling sugar; slightly efflorescent. Lead oxide dissolved in acetic acid. (Fig. 98.) *Colour*—White; often sparkling in the light. Odourless. *Taste*—Sweet; astringent.
Lead carbonate . . . . . . $PbCO_3$. **Carbonas plumbicus.** (*Plumbi carbonas.*)	Heavy, soft powder; soluble in dilute acetic acid ("White lead;" in commerce, obtained from lead exposed to fumes of acetic and carbonic acids, the first uniting with the metal, and the second displacing it). *Colour*—White. Odourless and tasteless.

Lead iodide PbI_2.	**Iodidum plumbicum.** (*Plumbi iodidum.*)	Crystalline laminar masses; often reduced to powder, soluble in boiling water. (Fig. 113.) *Colour*—Magnificent yellow. Potassium iodide (two molecules). $2KI$. Lead nitrate. $Pb2NO_3$. give **Lead iodide.** PbI_2. Potassium nitrate (two molecules). $2KNo_3$.
Lead nitrate $Pb2NO_3$.	**Nitras plumbicus.** (*Plumbi nitras*).	Nitrate. By dissolving the metal or the oxide in warm nitric acid. (Fig. 290.) PbS. Sulphide, black (Galena).

(ζ) Gold Class.

1. *Aurum* Au.		Gold. Yellow metal; not acted on by nitric acid, but only by chlorine (free, or in nitro-hydrochloric acid). Two oxides and two chlorides, of which the trichloride ($AuCl_3$) is the principal salt.
2. *Platinum* Pt.		Platinum. Silver-white metal; not acted on by nitric acid, but only by chlorine (aqua regia). Two oxides and two chlorides, of which the platinic chloride ($PtCl_4$) is most used.

SECTION IV.

PHARMACY.

THIS Section will be devoted to the Pharmacopœia. Its object is to afford assistance in explaining and reducing to a system the preparation of pharmaceutical products, which is essentially a subject requiring much time spent in actual manipulation, and that cannot be acquired, in any satisfactory way, without serious practical work and lengthened experience in the laboratory.

The Section will be divided into three heads:—

I. Preparations of the Pharmacopœia.
II. Organic Chemicals.
III. Groupings of Active Ingredients.

PART I.—Preparations of the Pharmacopœia.

1.—PREPARATIONS.

Class.	*Article.*	*Characteristics and Remarks.*
Aceta .	Acetum cantharidis .	Bright, dark, powerful vesicant; very pungent odour.
	,, scillæ . .	Very weak; preserved with a little proof spirit.
Acida .	Ac. sulph. arom. .	The aroma of two spices, removed and preserved with rect. spirit and acid. *Colour*—Light yellow-brown. *Odour*—Aromatic.
Adeps .	A. benzoatus . .	The lard has a slight odour of benzoin. By this treatment (with benzoin) it remains fresh for a length of time; it is immeasurably superior to the old practice of the addition of common salt.

Aquæ		These are generally a suspension of a small amount of the essential oil in water. They are either aromatic or fragrant, and from their nature (the oil being insoluble) weak, and generally used as menstrua for the exhibition of stronger medicines. They are colourless, limpid, and have the characteristics of ordinary water, with an aromatic odour. Aqua camphoræ is a simple maceration and partial solution in water; Aq. lauro-cerasi contains hydrocyanic acid, and is therefore very powerful in its action.
Cataplasmata		These poultices are always made up at the very moment they are required. The oil has a beneficial effect in Cataplasma lini in aiding the preservation of a moist heat.
Chartæ .	C. epispastica . .	Pieces of paper with a thin coating of a whitish adhesive plaister on one side, showing the bright specks of cantharides.
Confectiones		These are preparations in which the active ingredients are diffused through some soft and moist medium, so as to produce a semi-fluid condition; they do not possess as much firmness as the "pilulæ," though more than the "unguenta" of the Pharmacopœia.
	C. opii . . .	Dark brown; aromatic odour; the compound "pulvis" mixed with syrup.
	,, rosæ can. . .	Bright red; often used as a pill excipient where the quality of "adhesiveness" has to be given to the mass—*ex. gr.*, Pil. quiniæ. If freshly made, often too soft and fluid.
	,, ,, gallic. . .	Dark red; sweet; of thick consistence. (Fig. 172.)
	,, sennæ . .	Dark blackish green mass; should be smooth and uniform. *Odour*—Pleasant. *Taste*—Sweet.
	,, sulphuris . .	Bright yellow, acquiring a very disagreeable odour by being kept.
Decocta		Their name indicates that the ingredients are wholly or partially exhausted by water in a state of ebullition; afterwards strained, and, if necessary, further diluted. They require to be made shortly before being actually required, as they will not keep for any length of time.
	D. aloes comp. .	Dark, thick, reddish black liquid, with aromatic odour. On account of the presence of alcohol in the Tr. card. comp., this decoction, if made with care, will keep for years. The two gum-resins (aloes in ext. and myrrh) seem to be suspended, as an emulsion, by the carb. potash.
	,, sarsæ comp. .	Dark brown. *Odour*—Slightly aromatic (sassafras). *Taste*—Sweetish (liquorice) and peculiar, *sui generis* (sarsaparilla).
Emplastra , ...		Intended to be spread on leather, linen, &c., for outward application. They are either— (α) Hard, requiring the action of heat to effect their fusion, *ex. gr.* Emp. picis co. (β) Soft, but requiring heat in their spreading, *ex. gr.* ,, belladonnæ. (γ) Soft, necessitating simple pressure, *ex. gr.* ,, cantharidis.

Class.	*Article.*	*Characteristics and Remarks.*
Emplastra—continued.		
		The principal plaister, the basis of so many of the Pharmacopœia formulæ, is E. plumbi. It is an insoluble "soap," the saponification of olive-oil and oxide of lead, with heat and in the presence of water. It is moderately hard, yellowish white, with a slight though peculiar odour. With resin and hard soap, it forms respectively two important plaisters—E. resinæ and E. saponis—entering into the composition of several other plaisters.
	E. ammon. c. hyd.	So soft as to be generally in a viscid condition. *Colour*—Dirty yellowish brown. *Odour*—Disagreeable.
	,, cantharidis	Softish mass, with much *plasticity*, combining both firmness and adhesiveness. *Colour*—Dark olive-green, with bright sparkling green points. *Odour*—Faint, but of its degree penetrating.
	,, *cerat. saponis*	*Colour*—Yellowish brown.
	,, *ferri*	*Colour*—Dull reddish brown.
	,, hydrargyri	*Colour*—Dark bluish grey; firm, though not brittle. *Odour*—Slight, but unpleasant.
	,, picis	Hard and brittle. *Colour*—Bright brown-yellow. *Odour*—Slightly balsamic and aromatic.
Enemata		Mixtures or emulsions. With the exception of E. tabaci (an infusion) and E. opii (a simple mixture), they are real emulsions; *i.e.*, an oil or resin suspended in water by means of an alkali, gum, mucilage of starch, &c.
Essentiæ		A solution of essential oil in rectified spirit.
Extracta		These preparations, the greater number of soft though solid consistence, are intended to contain, extracted by the most suitable menstrua, the active principles of the simple drug. We may consider them under the following heads:—
1st. *Solid.*		
	(α) Green	The simple juice of the fresh plant expressed and evaporated, *ex. gr.* Ext. hyoscyam.
	(β) Aqueous	By means of water, rejecting what is insoluble:—1, Cold water, *ex. gr.* ,, aloes Soc. 2, Hot water, *ex. gr.* ,, gentian.
	(γ) Spirituous	By rectified spirit, *ex. gr.* ,, nux vomic.

(δ) Spirituous and aqueous.	1. Using the water to dilute the spirit,	*ex. gr.*	,, rhei.
	2. Using the two menstrua separately, and then mixing the extracts,	*ex. gr.*	,, jalap.
(ε) Aqueous, containing spirit.	An aqueous extract, adding spirit as a *conservative*,	*ex. gr.*	,, papaveris.
(ζ) Spirituous and ethereal.	1. With spirit and ether,	*ex. gr.*	,, mezereon.
	2. Removing the oil with ether,	*ex. gr.*	,, stramonii. ,, ergotæ.
2nd. *Liquid.*	These extracts are not evaporated to the solid state.		
(α) Aqueous .	1. Maceration in water, with spirit added to preserve it,	*ex. gr.*	,, sarsæ, belæ.
	2. Solution (as of extract) in water,	*ex. gr.*	,, opii.
(β) Spirituous.			
(γ) Ethereal. .	With ether,	*ex. gr.*	,, filicis maris.

E. aloes Bbds. (*a*) ,, aloes Soc. (β)	Dry mass, generally in small angular pieces. Very much the characters of the simple drug, but without the "resin"; not so aromatic or bright-looking. The former (α) (A. Bbds.) has a nauseous, the latter (β) (A. Soc.) a more aromatic odour. β (Fig. 173.)
,, belæ liq. . .	Dark brown, bright liquid; though with no strong odour. *Taste*—Astringent.
,, belladonnæ (*a*) . ,, hyoscyami (*b*) . ,, conii (*c*) . .	Plastic mass of what is called good pill consistence. Each has its peculiar odour, only to be distinguished by practice. Henbane has the strongest smell, though belladonna has the more powerful *sui generis* odour. Conium develops a mouse-like odour on being rubbed up with Liq. potass. *Colour*—In mass, dark olive-green brown; in thin coats, green (owing to the presence of chlorophyll). Simple fresh vegetable juices, with chlorophyll, and afterwards albumen, removed, with, on subsequent addition of the former, evaporation at low temperature. *a* (Fig. 174), *b* (Fig. 176), *c* (Fig. 175).
,, calumbæ . .	Thick, viscid, softish mass. *Colour*—Dark brown; light brown in thin layers. *Odour*—Not very characteristic. *Taste*—Very bitter. If badly made, burnt smell, and burnt half-sweetish taste.
,, cinch. flav. liq. .	Thickish liquid, though clear to reflected light. *Colour*—Dark brown in mass; yellowish red, tending to brown, in thin columns. *Odour*—Of cinchona, if carefully made. *Taste*—Very bitter. (Fig. 159.)

Class.	*Article.*	*Characteristics and Remarks.*
Extracta—continued.		
	E. colchici „ „ acet.	The evaporated "succus" or juice of the fresh corms deprived of its albumen. The acetic ext. simply differs in the acid having been added before the juice is pressed out. The latter has a strong smell of acetic acid; it is the only ext. that is acetous.
	„ coloc. co.	A tincture of colocynth, to which have been added Soc. aloes and scammony in their purest form (as ext. and resin respectively), with powdered cardamoms added at that point when their aroma will not be injured by further heat or prolonged evaporation. A hard, solid, brown-black mass, generally with smooth, shining surface. *Odour*—Strong (aloes brought out by soap) and aromatic (cardamoms). *Taste*—Nauseous and disagreeably bitter. (Fig. 177.)
	„ ergot. liquid.	A solution. Aqueous, with a small amount of spirit for conservation, of the active portion, deprived of albuminous matter by coagulation, of ergot of rye, from which the essential oil had been previously separated by washed ether. A dark liquid. *Colour*—Deep reddish brown. Little odour or taste. (Fig. 158.)
	„ filicis liquid.	An ethereal oil; or the oil (active principle), extracted with ether, from which the greater part of the latter has been recovered. Thick oily extract; semi-fluid; the oil with some ether remaining in it. *Colour*—Brownish green. *Odour*—Simply of ether. (Fig. 160.)
	„ gentian.	An evaporated infuso-decoction, of pilular consistence. *Colour*—Dark brown. *Taste*—Very bitter. (Fig. 178.)
	„ glycyrrh.	Double, lengthened maceration in cold; deprived, by usual heat, of albumen. *Colour*—Light yellowish brown. *Odour*—Insipid, resembling caramel. *Taste*—Sweetish.
	„ hæmatox.	A dry, smooth, hard, brittle mass, more lustrous than catechu, but not translucent, as kino. *Colour*—Black.
	„ jalapæ	Soft ductile mass. *Colour*—Dark brown. Strong peculiar odour and taste.
	„ humuli	Like Ext. jalapæ, a double extract, spirituous and aqueous, prepared separately (or rather the same hops *successively* exhausted), then mixed and evaporated. *Odour*—Faintly of lupulus.
	„ nux-vomic.	An evaporated tincture, portions of the spirit of which had successively treated, to exhaustion, the seeds powdered by steaming and rapid desiccation. Soft in nature. *Colour*—Dark brown. *Odour*—Scarcely characteristic. *Taste*—Intensely bitter.
	„ opii	A triple aqueous maceration. Soft, uniform mass (unlike the "tear-drops" in crude opium). *Colour*—Black. *Odour*—Very characteristic; a clear "opium" odour. *Taste*—Nauseous; bitter.

„ „ liquid.	The foregoing, dissolved in water, with spirit for conservation. *Colour*—Brownish black. *Odour*—As "Ext.," but spirituous also. *Taste*—As above; very nearly resembling the tincture.
„ papaveris.	An infusion by percolation, with spirit for preservation, the albumen, &c., having deposited and been removed before final evaporation. Thick viscid mass. *Colour*—Rich red-black brown. *Odour*—Somewhat resembling preparations of senna. *Taste*—Insipid.
„ pareiræ „ „ liq.	Evaporated infusion by percolation. The first evaporated to pilular consistence; the second only to a certain point (still fluid), and spirit added, with filtration. Thickish liquid. *Colour*—Dark brownish black. *Odour*—Slight; "woody." *Taste*—Bitter; of the root.
„ physostigmatis.	An evaporated tincture (by maceration, percolation, and pressure), with spirit recovered. Soft mass. *Colour*—Deep brown. Very poisonous.
„ rhei	A weak (*much* water, *little* spirit) tincture, filtered from the matter deposited on standing and evaporated. Thick firm mass; becomes by time very hard and intractable. *Colour*—Dark reddish brown. *Odour and Taste*—Essentially of the root; if well prepared, not to be mistaken.
„ sarsæ liquid.	The liquors, resulting from a double maceration, in hot water (160°), filtered, and then evaporated to a certain point only. Thick fluid, frothing much on being shaken. *Colour*—Dark brown-black; reddish brown in small quantities. *Odour and Taste*—Peculiar to sarsaparilla. (Fig. 161.)
„ stramonii.	An evaporated tincture, by percolation, with spirit recovered, of powdered seeds, previously deprived of their oil by washed ether. Firm, hard consistence. *Colour*—Black in mass. *Odour*—Strong; peculiar.
„ taraxaci	The juice of the fresh root, with the albumen removed by coagulation. Soft, yielding, with adhesiveness, but little firmness. *Colour*—Light brown, when good. *Odour*—Pleasant, resembling burnt sugar. *Taste*—Sweetish bitter. (Fig. 179.)
Fel. bovinum	That portion of the fresh ox-bile which is soluble in spirit, evaporated to a pilular consistence. Soft mass. *Colour*—Yellowish green. *Odour*—To most, distasteful and nauseous. *Taste*—Partly sweet, partly bitter. [Gives the colaic test with sulphuric acid.] (Fig. 181.)
Glycerina	Glycerine has the property of dissolving certain acids, salts, &c. The "Glycerina" are examples of this. With borax and carbolic acid, the solution is effected in the cold [*a*]; tannic and gallic acids require slight heat; in the case of starch, a high degree of heat (240°) is required to break up the granules. The physical appearance of these preparations is this: a translucent almost transparent liquid; thick and jelly-like. *Colour*—White, or colourless. *Odour*—Scarcely any, with exception of the Ac. carbolic glycerine. *Taste*—Sweetish, with the special taste of the acid or salt in solution. [*a*] (Fig. 183.)

T. IV.—Pharmacy—*continued.*

Class.	*Article.*	*Characteristics and Remarks.*
Infusa		Preparations which are to be made as required. If made as directed, they will not keep any length of time; it is, however, possible, by preparing and bottling in a special manner, to preserve them even without the addition of spirit; but it is not in our province to enter into these details of preparation. They are all made by pouring boiling water on the ingredient or ingredients, allowing the whole to stand for from fifteen minutes to four hours, and straining; with *six* exceptions, of which we select two:— (1) Inf. cusso is *not* strained, but taken, herb and water. (2) Inf. rosæ acidum is made with acidulated (sulphuric) water.
Jalapæ resina		The resin extracted by spirit (which is recovered), and afterwards dried. In small, opaque, bright, lustrous pieces, with angular edges; easily pulverized. *Powder*—Pale brown. *Fracture*—Resinous, shining, vitreous; translucent at edges. *Colour*—Dark brown. *Odour*—Not unpleasant; rather fragrant. *Taste*—Bitter, acrid. What is known as "Jalapine" is this article in a purer state, colourless, and finely divided. (Fig. 244.)
Linimenta		For external use only. The majority come under one of the following types:— (*a*) Mixture (semi-solid), *ex.* Lin. pot. iod. c. sap. (*b*) Liquid soap, *ex.* Lin. ammoniæ. ,, calcis. (*c*) Containing camphor and spirit, *ex.* Lin. belladonnæ. ,, aconiti. (*d*) Containing camphor and oil, *ex.* ,, chloroformi. ,, hydrargyri.
	L. ammoniæ	Thick, yellow, oily, liquid soap. *Odour*—Of ammonia.
	,, aconiti	As Lin. belladon. Tincture by percolation, with camphor in solution.
	,, calcis	Same appearance as Lin. ammon.
	,, camphoræ	Camphorated oil; one ounce to four fluid ounces. Presents the aspect of olive-oil, but with strong odour of camphor.
	,, ,, comp.	Tincture of camphor, perfumed with oil lavender, with ammonia so added as to give a clear solution. Colourless, with powerful odour.
	,, crotonis	A solution, in spirit, of two oils, croton and cajuput.
	,, iodi	A solution, in spirit, of iodine, aided by the presence of potassium iodide; containing also camphor. *Colour*—Reddish brown. *Odour*—Of iodine and camphor.
	,, potass. iodid. c. sapone.	A fragrant aqueous solution of the "essential" components with glycerine; becomes firm on cooling. *Colour*—White; translucent. *Odour*—Of lemons.

	,, saponis .	A spirituous (diluted with $\frac{1}{10}$ water) solution, by maceration, of soap and camphor, disguised with rosemary. *Colour*—Pale yellow. *Odour*—Camphoraceous, but somewhat fragrant.
Liquores		These are preparations, in the fluid state; for the most part aqueous. This class includes also those solutions, &c., that cannot well be placed in other categories. The majority are *colourless*, and prepared in the cold. We may classify *liquores* as follows:—
		(α) Simple solutions in water, *ex.* Liq. ammoniæ. ,, calcis.
		(β) Aqueous and spirituous, *ex.* ,, morph. acet.
		(γ) Acid or acidulated, *ex.* ,, arsenici hydrochloricus.
		(δ) Effervescent (through presence of gas), *ex.* ,, potassæ effervescens.
		(ε) Chemical salts, preparations remaining in the fluid state, or solutions of salts, *ex.* ,, antimonii chloridi. ,, arsenicalis.
		(ζ) Various menstrua, *ex.* ,, epispasticus. ,, iodi.
	L. ammoniæ . .	Aqueous solution of the gas. Colourless. Powerful ammoniacal odour. Pungent taste.
	,, antim. chlor. .	Antimonious chloride, in a fluid (and fairly pure) state. Heavy but mobile liquid. *Colour*—Dark yellowish red. *Odour*—Disagreeable; generally of chlorine. If added to water, antimonious oxide is precipitated.
	,, arsenicalis .	A fragrant solution of arsenic in potassium carbonate (or potassium arsenite may be formed in small quantity). Thin liquid, much diluted. *Colour*—Light red. *Odour*—Of lavender.
	,, arsenici hydrochloricus.	A solution of arsenious acid (arsenic) in hydrochloric acid.
	,, bismuth. et ammon. citratis.	This solution is on the same principle as the ferric ammonio-citrate, to which refer; in the presence of ammonia, the bismuth citrate becomes soluble in water. Clear and colourless. Odourless. *Taste*—Saline, and slightly metallic.
	,, calcis sacchar. .	A solution of lime in water, greatly aided by the presence of sugar in solution; contains nearly fourteen times as much lime dissolved as the ordinary liq. calcis. Colourless, clear, transparent. Odourless. *Taste*—Sweet.
	,, chlori . .	Solution of chlorine gas in water. Possesses strong bleaching properties. *Colour*—Pale yellowish green. *Odour*—Strongly of chlorine; suffocating and irritating to the throat.
	,, epispasticus	The active principle of the cantharis, removed by means of acetic acid (by maceration), dissolved in ether (by percolation). (Fig. 164.)

Class.	*Article.*	*Characteristics and Remarks.*
Liquores—continued.		
	L. ferri perchlor. fortior.	A solution, in water, of ferric chloride, oxidized by nitric acid from ferrous chloride, produced by treating iron with dilute hydrochloric acid. A bright, clear liquid. *Colour*—Orange-brown; blackish in bulk. *Taste*—Very astringent.
	,, ferri pernit. .	Same theory of formation as above. *Colour*—Bright reddish brown. *Taste*—Styptic; slightly acid.
	,, ,, persulph.	As above. *Colour*—Dense solution of a dark red. Inodorous. *Taste*—Strongly styptic.
	,, iodi . .	Iodine dissolved in a solution of potassium iodide. Iodine is very soluble in the presence of this latter salt. *Colour*—Reddish brown. *Odour and Taste*—Slightly of iodine.
	,, magn. carbon. .	Magnesium carbonate dissolved in water by the action of carbonic-acid gas. Colourless. Odourless. Almost tasteless.
	,, morph. acet. .	A solution of the salt in dilute spirit.
	,, plumbi subacet.	An aqueous solution of the salt, produced with the acetate and oxide. A lead oxyacetate; obtained by boiling together, in water, lead acetate and lead oxide. A dense, clear liquid. Colourless. Odourless. Sweetish, and slightly alkaline taste. Produces a white coating on glass.
	,, potassæ . . ,, sodæ . .	A caustic solution of the alkalies. Colourless. Odourless. To the touch, caustic, almost *oily*.
	,, sodæ chloratæ .	A solution of sodium carb., after the absorption of chlorine gas. A clear liquid. Colourless. *Odour*—Slightly of chlorine. *Taste*—Alkaline; astringent.
Lotiones .	Lotio hydrarg. nig. .	Colourless liquid, with black precipitate, suspended on shaking.
Misturæ .	. . . . .	These are either (1) Emulsions, *ex.* Mistura ammoniaci. (2) A compound of several constituents, *ex.* ,, sennæ comp.
	M. ammoniaci .	The oleo-gum-resin triturated in water. A milky fluid, with odour of the gum-resin.
	,, creosoti . .	Thin syrup, holding in suspension creosote, previously mixed with glacial acetic acid. *Odour and Taste*—Of creosote.
	,, ferri comp. .	Ferrous carbonate, preserved in an aromatic emulsion of myrrh. A milky liquid, with aromatic smell and taste; whitish green in colour, becoming brown by exposure to air.
	,, scammonii .	A simple emulsion of the "resin" with milk.

,, sennæ comp. .	The ordinary "haustus niger." *Colour*—Black, but clear. *Odour*—Aromatic (cardamoms). *Taste*—Rather bitter, but aromatic and sweetened (liquorice).
Mucilagines	A solution or diffusion of gum or starch in water.
. . . .	These are obtained either by— (1) Distillation, as *ol. caryoph.*, *ol. lavand.* (2) Expression, with or without the aid of heat, as *ol. amygd.*, *ol. ricini.* (3) Extraction, by treatment with simple heat of low temperature, as *ol. morrhuæ.* (4) Chemical formation, as *ol. sinapis ess.*, *ol. amygd. ess.*
1. Essential oils, by distillation.	The oils are *generally* light yellow, all with powerful odours peculiar to the substances from which they have been distilled, and with hot, often even acrid, taste.
O. anisi . . .	Pale yellow; at cool temperatures (50°), solidifies to mass of crystals.
,, anthemidis. .	Pale blue, with odour of flowers.
,, cajaputi . .	Bright green, mobile, transparent. Strong odour, and aromatic *cool* taste. (Fig. 133.)
,, carui . . .	Colourless. Odour and taste of the "seeds" (fruits).
,, caryophylli .	Thick, *heavy* liquid; colourless, but becoming brown by exposure. Smell and taste of cloves.
,, lavandulæ . .	Colourless or pale yellow, with odour of flowers, and hot, aromatic taste.
,, limonis . .	Generally termed "essence." Distilled or expressed from rind of fruit. Pale yellow, with pleasant, fragrant odour.
,, sabinæ . .	Colourless or pale yellow. *Odour*—Peculiar, between the juniper and the fir.
,, terebinthinæ .	Colourless; limpid. *Odour*—Strong, disagreeable. *Taste*—Hot, acrid; nauseous.
2. Fixed oils, by expression.	
O. amygdalæ. .	Thick, though limpid. Pale yellow. Almost odourless. Bland taste; not disagreeable. (Fig. 134.)
,, crotonis . .	Very thick, but bright and clear. *Colour*—Brownish yellow; red by transmitted, greenish brown by reflected light (this is generally the case). *Odour and Taste*—Acrid; nauseous. (Fig. 132.)
,, myristicæ express.	In solid blocks, generally long, oblong, and enveloped in "dry leaf." *Colour*—Bright orange. *Odour*—Like that of nutmegs. (Fig. 184.)
,, olivæ . . .	Thin, clear liquid. Pale yellow. The slight odour and taste existing are peculiar to the olive, and are *not* unpleasant.
,, ricini . . .	Thick, viscid oil. Colourless. Odourless. Tasteless, or with slight acridity to the throat.

Class.	*Article.*	*Characteristics and Remarks.*
Olea—continued.		
	O. theobromæ	Solid concrete fat, expressed in manufacture of chocolate. *Colour*—Yellowish white. *Odour*—Of chocolate. Tasteless, with no rancidity. *Fracture*—Clean; short. (Fig. 85*.)
	3. Extraction, by simple heat.	
	O. morrhuæ	A thin, clear, bright oil, turning cloudy in cold weather. *Colour*—Very pale yellow. *Odour*—Very slight of fish. *Taste*—Bland. The odour and taste should be perfectly fresh, and almost agreeable. (Fig. 135.)
Pilulæ		The pills form an important class among the preparations of the Pharmacopœia. These pill-masses may be classed under the several divisions, given in the Section of "Practical Dispensing" (page 84), according to the excipients directed to be employed. They all ought to be in a good *plastic* condition, possessing firmness with soft, slightly moist adhesiveness. Many are rendered aromatic with an essential oil. The greater number, owing to their constituents, have a dark yellow- or red-brown colour.
	P. aloes Barb.	*Colour*—Dark brown. *Odour*—Aromatic. *Taste*—Warm bitter.
	,, aloes et myrrh.	*Colour*—Dark orange-brown. *Odour*—Slightly of saffron. (Fig. 167.)
	,, assafœtid. comp.	Prepared by heat. *Odour*—Fœtid, of assafœtida. *Taste*—Acrid.
	,, cambogiæ ,,	Camboge and aloes (Bbds.), with cinnamon as an aromatic, syrup for adhesiveness, and powdered soap for firmness. (Fig. 166.)
	,, coloc. co.	An intimate mixture of aloes and scammony (aided by the presence of sulphate of potash), with powdered colocynth. *Colour*—Dark brown. *Odour*—Aromatic (cloves). *Taste*—Very bitter.
	,, ferri iodid.	Contains ferrous iodide, added in its *nascent* state to powdered sugar and liquorice-root for preservation. *Colour*—Dark brown-black. *Odour*—Of iodine.
	,, hydrargyri	Soft, yet solid mass. *Colour*—Bluish grey.
	,, quiniæ	A simple mixture of quinia with confection of hips. *Colour*—Light red. *Taste*—Bitter.
	,, rhei comp.	Powders, added to treacle and flavoured with oil of peppermint. *Colour*—Yellow-brown. *Odour*—Aromatic, of rhubarb. *Taste*—Warm bitter. (Fig. 165.)
	,, saponis co.	Opium in powder, made up with water and powdered soap.
Podophylli resina		Podophylline. Pale greenish-brown amorphous powder. [See page 3.] (Fig. 122.)

Pulveres		These are mixtures of powders, all, with the exception of the three following, directed to be passed, after a thorough mixture, through a fine sieve. Pulv. amygd. comp. The almonds to be blanched and coarsely powdered. ,, antimonialis } ,, tragac. comp. } Simply to be mixed thoroughly. Their physical characters depend on those of their several ingredients; those of the principal one predominating.
	P. antimon.	Heavy, white powder; odourless and tasteless, or with a slight *earthy* taste: one part of antimonious oxide to two parts of calcium phosphate.
	,, catechu comp.	Reddish brown. *Odour*—Of spices. *Taste*—Astringent.
	,, cretæ aromat.	Bright orange-yellow. *Odour*—Aromatic. *Taste*—Sweetish. (Fig. 138.)
	,, ipecac. comp.	Light brown. *Odour and Taste*—Of opium and ipecacuanha.
	,, jalapæ comp.	Light brown. *Odour*—Of jalap. *Taste*—Sharp; nauseous.
	,, opii comp.	Dark yellowish brown. *Odour*—Aromatic. *Taste*—Warm.
	,, rhei comp.	The former "Gregory's Powder." Light pinkish yellow. Aromatic.
	,, tragac. comp.	A mixture of gums, starch, and sugar. White; odourless. Sweet in taste.
		N.B.—Examples of the principal drugs *in powder* are given in Figs. 139 to 150.
Sapones		Ordinary "hard" and "soft" soap; the former the result of saponification between olive-oil and soda, the latter between olive-oil and potash. The former is hard, greyish white, dry, horny, inodorous; the latter is soft, gelatinous, yellowish green.
Spiritus		Some of these (three) will be found under "Organic Chemicals." The majority are solutions of essential oils (also camphor, chloroform) in rectified spirit. Spt. armoraciæ comp. (proof spirit and water) is a distilled product. They may be considered as strong tinctures of the essential oils; generally colourless, with the peculiar odour and taste of the essential oil, &c., held in solution. Spt. armoraciæ comp. has an aromatic odour and pungent taste. Spt. camphoræ and spt. chloroformi have a strong odour of their respective constituents.
Succi		These are the fresh juices of the plant, with one-fourth part rectified spirit added for conservation. They possess the peculiar taste and smell of the fresh plant.
	Succus taraxaci.	Thin, clear, bright liquid. *Colour*—Light reddish brown. *Odour*—Of fresh dandelion-root. *Taste*—Peculiar; rather aromatic; agreeable. (Fig. 163.)
Suppositoria		In hard, fatty masses, divided in conical forms. Contain oil of theobroma (Butyr cacaonis), wax, and lard, acting as menstrua for a powerful medicine. Hard, generally whitish, with little odour. S. morphiæ.

Class.	*Article.*	*Characteristics and Remarks.*
Syrupi		Syrup (or sugar dissolved in water) is a pleasant vehicle for the administration of many medicines. They are always thick, slightly viscid, with odour and taste of the principal ingredients, and necessarily sweet.
	S. aurantii . .	Yellowish. Has the pleasant taste and odour of orange-peel.
	,, ferri iodidi .	A solution of ferrous iodide in syrup. *Colour*—Light greenish yellow. Little odour. *Taste*—Sweet, with taste both of iron and of iodine. (Fig. 162.)
	,, ferri phosphat. .	Clear, translucent solution. Ferrous phosphate, dissolved in dilute phosphoric acid, to which is added sugar. Colourless. Odourless. *Taste*—Slightly of iron.
	,, hemidesmi .	An infusion, with sugar added. Peculiar flavour of the hemidesmus.
	,, papaveris . .	Sugar, added to a percolated and partially-evaporated infusion. Thick, viscid fluid. *Colour*—Dark brown. *Odour and Taste*—Slightly narcotic.
	,, rhamni . .	The "succus" evaporated, spiced, with a little spirit to it, and sugar added. Thick liquid. *Colour*—Dark purple-red. *Taste*—Acrid; slightly aromatic.
	,, rhei . . .	A weak tincture, sweetened. *Colour*—Dark yellow-red. *Taste or Odour*—Of rhubarb and coriander.
	,, rhœados . .	An infusion, with sugar added, and spirit to preserve it. *Colour*—Bright red. No special odour or taste.
	,, scillæ . .	Acetous. *Colour*—Yellow-brown. *Odour and Taste*—Acetous.
	,, sennæ . .	A double digestion in water, evaporated, with spirit added. When filtered, sugar added. *Colour*—Yellowish brown. *Odour and Taste*—Of senna; slightly aromatic.
	,, tolutanus . .	Sugar, added to a decoction of the aqueous matter of tolu balsam. *Colour*—Pale yellow. *Odour and Taste*—Of tolu.
Tincturæ		These are very important, and without doubt the more extensively used of the several preparations of the Pharmacopœia. They may be classed as follows, according to the menstruum employed:— (*a*) Rectified spirit, as *tinct. benzoini comp.*, for articles of a resinous nature, &c. (*b*) Proof spirit, as *tinct. cardam. comp.*, for herbs, leaves, many roots, &c. (*c*) Ammonia, (1) Arom. spirit of ammonia, as *tinct. guaiaci ammon.* (2) Rect. spirit and solution of ammon., as *tinct. opii ammon.* (*d*) Ether. Ether and spirit, as *tinct. lobeliæ ætherea.*

The general process, in the majority of cases, may be described as follows: Maceration for forty-eight hours (in several cases seven days), percolation, pressure, filtration, mixture of several liquors, and, if necessary, as in some cases, the further addition of spirit. Their physical characters do not show much variety. Generally thin, clear, bright, transparent liquids, yellow or reddish brown, with the peculiar odour and taste of the ingredients, though often partially masked by the spirit.

We will now notice the special physical characteristics of some individual tinctures.

T. aconiti . .	As other tinctures of roots and leaves; bright, clear yellow, with little special odour.
,, aloes . .	Dark-coloured. *Taste*—Bitter.
,, assafœtid. .	Peculiar odour of the gum-resin; fœtid.
,, aurantii .	Pleasant taste, and smell of orange-peel. Yellow in colour.
,, benzoini comp.	Thick, semi-viscid fluid, with fragrant odour. Dark red-brown black. Orange in small columns. (Fig. 153.)
,, calumbæ .	Light orange; with very bitter taste.
,, camph. comp.	Light yellow-orange; disagreeable smell of camphor and oil of anise. Contains opium.
,, capsici . .	Hot, pungent taste.
,, cardam. comp.	Bright red clear liquid. Aromatic in odour and taste. Coloured with cochineal. (Fig. 151.)
,, catechu . .	Dark brown-black. Very astringent.
,, cinchonæ comp.	Reddish yellow. Aromatic taste. Tonic, slightly bitter. "Pale" bark.
,, cinchonæ flavæ	Dark yellowish brown-red Bitter; febrifuge in taste. "Yellow" bark. (Fig. 152.)
,, conii . .	Light brown. Peculiar smell of conium (brought out by liq. potassæ). From the "fruit."
,, croci . .	Bright yellow-orange. Used as a colouring.
,, ergotæ . .	Clear reddish brown. Faint nauseous smell and taste.
,, ferri acetatis .	Bright solution. Orange-red. *Taste*—Slightly acetous; strongly of iron.
,, ,, perchlor.	Bright clear orange-yellow. *Odour and Taste*—Strongly ferruginous.
,, gentian. comp.	Bright brownish orange. *Odour*—Aromatic. *Taste*—Bitter, but still pleasantly flavoured.
,, guaiaci ammon.	Dark reddish brown. Strong odour, and taste of ammonia (slightly aromatic).
,, iodi . .	Dark reddish brown; bright red by transmitted light. *Odour and Taste*—Of iodine.
,, lavand. comp.	Clear liquid of a dark *red* colour. Fragrant; and especially of lavender.
,, lobeliæ æther.	Strong odour of ether.
,, myrrhæ . .	Reddish yellow. Odour and flavour of myrrh.

Class.	*Article.*	*Characteristics and Remarks.*
Extracta—continued.		
	E. colchici „ „ acet.	The evaporated "succus" or juice of the fresh corms deprived of its albumen. The acetic ext. simply differs in the acid having been added before the juice is pressed out. The latter has a strong smell of acetic acid; it is the only ext. that is acetous.
	„ coloc. co.	A tincture of colocynth, to which have been added Soc. aloes and scammony in their purest form (as ext. and resin respectively), with powdered cardamoms added at that point when their aroma will not be injured by further heat or prolonged evaporation. A hard, solid, brown-black mass, generally with smooth, shining surface. *Odour*—Strong (aloes brought out by soap) and aromatic (cardamoms). *Taste*—Nauseous and disagreeably bitter. (Fig. 177.)
	„ ergot. liquid.	A solution. Aqueous, with a small amount of spirit for conservation, of the active portion, deprived of albuminous matter by coagulation, of ergot of rye, from which the essential oil had been previously separated by washed ether. A dark liquid. *Colour*—Deep reddish brown. Little odour or taste. (Fig. 158.)
	„ filicis liquid.	An ethereal oil; or the oil (active principle), extracted with ether, from which the greater part of the latter has been recovered. Thick oily extract; semi-fluid; the oil with some ether remaining in it. *Colour*—Brownish green. *Odour*—Simply of ether. (Fig. 160.)
	„ gentian.	An evaporated infuso-decoction, of pilular consistence. *Colour*—Dark brown. *Taste*—Very bitter. (Fig. 178.)
	„ glycyrrh.	Double, lengthened maceration in cold; deprived, by usual heat, of albumen. *Colour*—Light yellowish brown. *Odour*—Insipid, resembling caramel. *Taste*—Sweetish.
	„ hæmatox.	A dry, smooth, hard, brittle mass, more lustrous than catechu, but not translucent, as kino. *Colour*—Black.
	„ jalapæ	Soft ductile mass. *Colour*—Dark brown. Strong peculiar odour and taste.
	„ humuli	Like Ext. jalapæ, a double extract, spirituous and aqueous, prepared separately (or rather the same hops *successively* exhausted), then mixed and evaporated. *Odour*—Faintly of lupulus.
	„ nux-vomic.	An evaporated tincture, portions of the spirit of which had successively treated, to exhaustion, the seeds powdered by steaming and rapid desiccation. Soft in nature. *Colour*—Dark brown. *Odour*—Scarcely characteristic. *Taste*—Intensely bitter.
	„ opii	A triple aqueous maceration. Soft, uniform mass (unlike the "tear-drops" in crude opium). *Colour*—Black. *Odour*—Very characteristic; a clear "opium" odour. *Taste*—Nauseous; bitter.

„ „ liquid.	The foregoing, dissolved in water, with spirit for conservation. *Colour*—Brownish black. *Odour*—As "Ext.," but spirituous also. *Taste*—As above; very nearly resembling the tincture.
„ papaveris.	An infusion by percolation, with spirit for preservation, the albumen, &c., having deposited and been removed before final evaporation. Thick viscid mass. *Colour*—Rich red-black brown. *Odour*—Somewhat resembling preparations of senna. *Taste*—Insipid.
„ pareiræ „ „ liq.	Evaporated infusion by percolation. The first evaporated to pilular consistence; the second only to a certain point (still fluid), and spirit added, with filtration. Thickish liquid. *Colour*—Dark brownish black. *Odour*—Slight; "woody." *Taste*—Bitter; of the root.
„ physostigmatis	An evaporated tincture (by maceration, percolation, and pressure), with spirit recovered. Soft mass. *Colour*—Deep brown. Very poisonous.
„ rhei	A weak (*much* water, *little* spirit) tincture, filtered from the matter deposited on standing and evaporated. Thick firm mass; becomes by time very hard and intractable. *Colour*—Dark reddish brown. *Odour and Taste*—Essentially of the root; if well prepared, not to be mistaken.
„ sarsæ liquid.	The liquors, resulting from a double maceration, in hot water (160°), filtered, and then evaporated to a certain point only. Thick fluid, frothing much on being shaken. *Colour*—Dark brown-black; reddish brown in small quantities. *Odour and Taste*—Peculiar to sarsaparilla. (Fig. 161.)
„ stramonii.	An evaporated tincture, by percolation, with spirit recovered, of powdered seeds, previously deprived of their oil by washed ether. Firm, hard consistence. *Colour*—Black in mass. *Odour*—Strong; peculiar.
„ taraxaci	The juice of the fresh root, with the albumen removed by coagulation. Soft, yielding, with adhesiveness, but little firmness. *Colour*—Light brown, when good. *Odour*—Pleasant, resembling burnt sugar. *Taste*—Sweetish bitter. (Fig. 179.)
Fel. bovinum	That portion of the fresh ox-bile which is soluble in spirit, evaporated to a pilular consistence. Soft mass. *Colour*—Yellowish green. *Odour*—To most, distasteful and nauseous. *Taste*—Partly sweet, partly bitter. [Gives the colaic test with sulphuric acid.] (Fig. 181.)
Glycerina	Glycerine has the property of dissolving certain acids, salts, &c. The "Glycerina" are examples of this. With borax and carbolic acid, the solution is effected in the cold [a]; tannic and gallic acids require slight heat; in the case of starch, a high degree of heat (240°) is required to break up the granules. The physical appearance of these preparations is this: a translucent almost transparent liquid; thick and jelly-like. *Colour*—White, or colourless. *Odour*—Scarcely any, with exception of the Ac. carbolic glycerine. *Taste*—Sweetish, with the special taste of the acid or salt in solution. [a] (Fig. 183.)

Class.	*Article.*	*Characteristics and Remarks.*
Infusa		Preparations which are to be made as required. If made as directed, they will not keep any length of time; it is, however, possible, by preparing and bottling in a special manner, to preserve them even without the addition of spirit; but it is not in our province to enter into these details of preparation. They are all made by pouring boiling water on the ingredient or ingredients, allowing the whole to stand for from fifteen minutes to four hours, and straining; with *six* exceptions, of which we select two:— (1) Inf. cusso is *not* strained, but taken, herb and water. (2) Inf. rosæ acidum is made with acidulated (sulphuric) water.
Jalapæ resina		The resin extracted by spirit (which is recovered), and afterwards dried. In small, opaque, bright, lustrous pieces, with angular edges; easily pulverized. *Powder*—Pale brown. *Fracture*—Resinous, shining, vitreous; translucent at edges. *Colour*—Dark brown. *Odour*—Not unpleasant; rather fragrant. *Taste*—Bitter, acrid. What is known as "Jalapine" is this article in a purer state, colourless, and finely divided. (Fig. 244.)
Linimenta		For external use only. The majority come under one of the following types:— (*a*) Mixture (semi-solid), *ex.* Lin. pot. iod. c. sap. (*b*) Liquid soap, *ex.* Lin. ammoniæ. ,, calcis. (*c*) Containing camphor and spirit . . *ex.* Lin. belladonnæ. ,, aconiti. (*d*) Containing camphor and oil . . *ex.* ,, chloroformi. ,, hydrargyri.
	L. ammoniæ	Thick, yellow, oily, liquid soap. *Odour*—Of ammonia.
	,, aconiti	As Lin. belladon. Tincture by percolation, with camphor in solution.
	,, calcis	Same appearance as Lin. ammon.
	,, camphoræ	Camphorated oil; one ounce to four fluid ounces. Presents the aspect of olive-oil, but with strong odour of camphor.
	,, ,, comp.	Tincture of camphor, perfumed with oil lavender, with ammonia so added as to give a clear solution. Colourless, with powerful odour.
	,, crotonis	A solution, in spirit, of two oils, croton and cajuput.
	,, iodi	A solution, in spirit, of iodine, aided by the presence of potassium iodide; containing also camphor. *Colour*—Reddish brown. *Odour*—Of iodine and camphor.
	,, potass. iodid. c. sapone.	A fragrant aqueous solution of the "essential" components with glycerine; becomes firm on cooling. *Colour*—White; translucent. *Odour*—Of lemons.

	,, saponis .	A spirituous (diluted with $\frac{1}{10}$ water) solution, by maceration, of soap and camphor, disguised with rosemary. *Colour*—Pale yellow. *Odour*—Camphoraceous, but somewhat fragrant.
Liquores		These are preparations, in the fluid state; for the most part aqueous. This class includes also those solutions, &c., that cannot well be placed in other categories. The majority are *colourless*, and prepared in the cold. We may classify *liquores* as follows:— (α) Simple solutions in water, *ex.* Liq. ammoniæ. ,, calcis. (β) Aqueous and spirituous, *ex.* ,, morph. acet. (γ) Acid or acidulated, *ex.* ,, arsenici hydrochloricus. (δ) Effervescent (through presence of gas), *ex.* ,, potassæ effervescens. (ε) Chemical salts, preparations remaining in the fluid state, or solutions of salts, *ex.* ,, antimonii chloridi. ,, arsenicalis. (ζ) Various menstrua, *ex.* ,, epispasticus. ,, iodi.
	L. ammoniæ . .	Aqueous solution of the gas. Colourless. Powerful ammoniacal odour. Pungent taste.
	,, antim. chlor. .	Antimonious chloride, in a fluid (and fairly pure) state. Heavy but mobile liquid. *Colour*—Dark yellowish red. *Odour*—Disagreeable; generally of chlorine. If added to water, antimonious oxide is precipitated.
	,, arsenicalis .	A fragrant solution of arsenic in potassium carbonate (or potassium arsenite may be formed in small quantity). Thin liquid, much diluted. *Colour*—Light red. *Odour*—Of lavender.
	,, arsenici hydrochloricus.	A solution of arsenious acid (arsenic) in hydrochloric acid.
	,, bismuth. et ammon. citratis.	This solution is on the same principle as the ferric ammonio-citrate, to which refer; in the presence of ammonia, the bismuth citrate becomes soluble in water. Clear and colourless. Odourless. *Taste*—Saline, and slightly metallic.
	,, calcis sacchar. .	A solution of lime in water, greatly aided by the presence of sugar in solution; contains nearly fourteen times as much lime dissolved as the ordinary liq. calcis. Colourless, clear, transparent. Odourless. *Taste*—Sweet.
	,, chlori . .	Solution of chlorine gas in water. Possesses strong bleaching properties. *Colour*—Pale yellowish green. *Odour*—Strongly of chlorine; suffocating and irritating to the throat.
	,, epispasticus	The active principle of the cantharis, removed by means of acetic acid (by maceration), dissolved in ether (by percolation). (Fig. 164.)

Class.	*Article.*	*Characteristics and Remarks.*
Liquores—continued.		
	L. ferri perchlor. fortior.	A solution, in water, of ferric chloride, oxidized by nitric acid from ferrous chloride, produced by treating iron with dilute hydrochloric acid. A bright, clear liquid. *Colour*—Orange-brown; blackish in bulk. *Taste*—Very astringent.
	„ ferri pernit.	Same theory of formation as above. *Colour*—Bright reddish brown. *Taste*—Styptic; slightly acid.
	„ „ persulph.	As above. *Colour*—Dense solution of a dark red. Inodorous. *Taste*—Strongly styptic.
	„ iodi	Iodine dissolved in a solution of potassium iodide. Iodine is very soluble in the presence of this latter salt. *Colour*—Reddish brown. *Odour and Taste*—Slightly of iodine.
	„ magn. carbon.	Magnesium carbonate dissolved in water by the action of carbonic-acid gas. Colourless. Odourless. Almost tasteless.
	„ morph. acet.	A solution of the salt in dilute spirit.
	„ plumbi subacet.	An aqueous solution of the salt, produced with the acetate and oxide. A lead oxyacetate; obtained by boiling together, in water, lead acetate and lead oxide. A dense, clear liquid. Colourless. Odourless. Sweetish, and slightly alkaline taste. Produces a white coating on glass.
	„ potassæ „ sodæ	A caustic solution of the alkalies. Colourless. Odourless. To the touch, caustic, almost *oily*.
	„ sodæ chloratæ	A solution of sodium carb., after the absorption of chlorine gas. A clear liquid. Colourless. *Odour*—Slightly of chlorine. *Taste*—Alkaline; astringent.
Lotiones	Lotio hydrarg. nig.	Colourless liquid, with black precipitate, suspended on shaking.
Misturæ		These are either (1) Emulsions, *ex.* Mistura ammoniaci. (2) A compound of several constituents, *ex.* „ sennæ comp.
	M. ammoniaci	The oleo-gum-resin triturated in water. A milky fluid, with odour of the gum-resin.
	„ creosoti	Thin syrup, holding in suspension creosote, previously mixed with glacial acetic acid. *Odour and Taste*—Of creosote.
	„ ferri comp.	Ferrous carbonate, preserved in an aromatic emulsion of myrrh. A milky liquid, with aromatic smell and taste; whitish green in colour, becoming brown by exposure to air.
	„ scammonii	A simple emulsion of the "resin" with milk.

,, sennæ comp.	The ordinary "haustus niger." *Colour*—Black, but clear. *Odour*—Aromatic (cardamoms). *Taste*—Rather bitter, but aromatic and sweetened (liquorice).
Mucilagines	A solution or diffusion of gum or starch in water.
	These are obtained either by— (1) Distillation, as *ol. caryoph.*, *ol. lavand.* (2) Expression, with or without the aid of heat, as *ol. amygd.*, *ol. ricini.* (3) Extraction, by treatment with simple heat of low temperature, as *ol. morrhuæ.* (4) Chemical formation, as *ol. sinapis ess.*, *ol. amygd. ess.*
1. Essential oils, by distillation.	The oils are *generally* light yellow, all with powerful odours peculiar to the substances from which they have been distilled, and with hot, often even acrid, taste.
O. anisi	Pale yellow; at cool temperatures (50°), solidifies to mass of crystals.
,, anthemidis	Pale blue, with odour of flowers.
,, cajaputi	Bright green, mobile, transparent. Strong odour, and aromatic *cool* taste. (Fig. 133.)
,, carui	Colourless. Odour and taste of the "seeds" (fruits).
,, caryophylli	Thick, *heavy* liquid; colourless, but becoming brown by exposure. Smell and taste of cloves.
,, lavandulæ	Colourless or pale yellow, with odour of flowers, and hot, aromatic taste.
,, limonis	Generally termed "essence." Distilled or expressed from rind of fruit. Pale yellow, with pleasant, fragrant odour.
,, sabinæ	Colourless or pale yellow. *Odour*—Peculiar, between the juniper and the fir.
,, terebinthinæ	Colourless; limpid. *Odour*—Strong, disagreeable. *Taste*—Hot, acrid; nauseous.
2. Fixed oils, by expression.	
O. amygdalæ	Thick, though limpid. Pale yellow. Almost odourless. Bland taste; not disagreeable. (Fig. 134.)
,, crotonis	Very thick, but bright and clear. *Colour*—Brownish yellow; red by transmitted, greenish brown by reflected light (this is generally the case). *Odour and Taste*—Acrid; nauseous. (Fig. 132.)
,, myristicæ express.	In solid blocks, generally long, oblong, and enveloped in "dry leaf." *Colour*—Bright orange. *Odour*—Like that of nutmegs. (Fig. 184.)
,, olivæ	Thin, clear liquid. Pale yellow. The slight odour and taste existing are peculiar to the olive, and are *not* unpleasant.
,, ricini	Thick, viscid oil. Colourless. Odourless. Tasteless, or with slight acridity to the throat.

Class.	*Article.*	*Characteristics and Remarks.*
Olea—continued.		
	O. theobromæ .	Solid concrete fat, expressed in manufacture of chocolate. *Colour*—Yellowish white. *Odour*—Of chocolate. Tasteless, with no rancidity. *Fracture*—Clean; short. (Fig. 85*.)
	3. Extraction, by simple heat.	
	O. morrhuæ . .	A thin, clear, bright oil, turning cloudy in cold weather. *Colour*—Very pale yellow. *Odour*—Very slight of fish. *Taste*—Bland. The odour and taste should be perfectly fresh, and almost agreeable. (Fig. 135.)
Pilulæ		The pills form an important class among the preparations of the Pharmacopœia. These pill-masses may be classed under the several divisions, given in the Section of "Practical Dispensing" (page 84), according to the excipients directed to be employed. They all ought to be in a good *plastic* condition, possessing firmness with soft, slightly moist adhesiveness. Many are rendered aromatic with an essential oil. The greater number, owing to their constituents, have a dark yellow- or red-brown colour.
	P. aloes Barb. .	*Colour*—Dark brown. *Odour*—Aromatic. *Taste*—Warm bitter.
	,, aloes et myrrh .	*Colour*—Dark orange-brown. *Odour*—Slightly of saffron. (Fig. 167.)
	,, assafœtid. comp.	Prepared by heat. *Odour*—Fœtid, of assafœtida. *Taste*—Acrid.
	,, cambogiæ ,,	Camboge and aloes (Bbds.), with cinnamon as an aromatic, syrup for adhesiveness, and powdered soap for firmness. (Fig. 166.)
	,, coloc. co. . .	An intimate mixture of aloes and scammony (aided by the presence of sulphate of potash), with powdered colocynth. *Colour*—Dark brown. *Odour*—Aromatic (cloves). *Taste*—Very bitter.
	,, ferri iodid. .	Contains ferrous iodide, added in its *nascent* state to powdered sugar and liquorice-root for preservation. *Colour*—Dark brown-black. *Odour*—Of iodine.
	,, hydrargyri .	Soft, yet solid mass. *Colour*—Bluish grey.
	,, quiniæ . .	A simple mixture of quinia with confection of hips. *Colour*—Light red. *Taste*—Bitter.
	,, rhei comp. .	Powders, added to treacle and flavoured with oil of peppermint. *Colour*—Yellow-brown. *Odour*—Aromatic, of rhubarb. *Taste*—Warm bitter. (Fig. 165.)
	,, saponis co. .	Opium in powder, made up with water and powdered soap.
Podophylli resina		Podophylline. Pale greenish-brown amorphous powder. [See page 3.] (Fig. 122.)

Pulveres		These are mixtures of powders, all, with the exception of the three following, directed to be passed, after a thorough mixture, through a fine sieve. Pulv. amygd. comp. The almonds to be blanched and coarsely powdered. ,, antimonialis } Simply to be mixed thoroughly. ,, tragac. comp. } Their physical characters depend on those of their several ingredients; those of the principal one predominating.
	P. antimon.	Heavy, white powder; odourless and tasteless, or with a slight *earthy* taste: one part of antimonious oxide to two parts of calcium phosphate.
	,, catechu comp.	Reddish brown. *Odour*—Of spices. *Taste*—Astringent.
	,, cretæ aromat.	Bright orange-yellow. *Odour*—Aromatic. *Taste*—Sweetish. (Fig. 138.)
	,, ipecac. comp.	Light brown. *Odour and Taste*—Of opium and ipecacuanha.
	,, jalapæ comp.	Light brown. *Odour*—Of jalap. *Taste*—Sharp; nauseous.
	,, opii comp.	Dark yellowish brown. *Odour*—Aromatic. *Taste*—Warm.
	,, rhei comp.	The former "Gregory's Powder." Light pinkish yellow. Aromatic.
	,, tragac. comp.	A mixture of gums, starch, and sugar. White; odourless. Sweet in taste. N.B.—Examples of the principal drugs *in powder* are given in Figs. 139 to 150.
Sapones		Ordinary "hard" and "soft" soap; the former the result of saponification between olive-oil and soda, the latter between olive-oil and potash. The former is hard, greyish white, dry, horny, inodorous; the latter is soft, gelatinous, yellowish green.
Spiritus		Some of these (three) will be found under "Organic Chemicals." The majority are solutions of essential oils (also camphor, chloroform) in rectified spirit. Spt. armoraciæ comp. (proof spirit and water) is a distilled product. They may be considered as strong tinctures of the essential oils; generally colourless, with the peculiar odour and taste of the essential oil, &c., held in solution. Spt. armoraciæ comp. has an aromatic odour and pungent taste. Spt. camphoræ and spt. chloroformi have a strong odour of their respective constituents.
Succi		These are the fresh juices of the plant, with one-fourth part rectified spirit added for conservation. They possess the peculiar taste and smell of the fresh plant.
	Succus taraxaci.	Thin, clear, bright liquid. *Colour*—Light reddish brown. *Odour*—Of fresh dandelion-root. *Taste*—Peculiar; rather aromatic; agreeable. (Fig. 163.)
Suppositoria		In hard, fatty masses, divided in conical forms. Contain oil of theobroma (Butyr cacaonis), wax, and lard, acting as menstrua for a powerful medicine. Hard, generally whitish, with little odour. S. morphiæ.

SECTION V.

PRESCRIPTIONS.

PART I.—**The Latin Language.**

THE study of the rudiments of this language is of very great importance, both with regard to the correct composition of prescriptions, and especially with regard to their accurate comprehension by the compounder.

In the construction of this language, we will divide the subject into two heads, each with several sub-divisions:—

A.—THE INDIVIDUAL WORD CONSIDERED BY ITSELF, OR ETYMOLOGY.

Under this head we may consider—

1. The actual meaning of the Latin word.
2. The part of speech, whether Noun, Verb, &c.
3. The termination.

B.—THE WORD CONSIDERED IN CONJUNCTION WITH OTHERS, OR SYNTAX.—This comprehends the building-up of the sentence from individual words, and the relation in which they stand to each other, whether as governing or as governed, and therefore, of necessity, the rules that influence the words and their terminations.

This includes—

1. Simple construction, as between two words . . { α Concord (or agreement between two words).
   β Government (of one word by another).
2. Complex construction of sentences (as of dependent sentences).
3. The idioms, or peculiar construction of the language { α Constructions peculiar to the language.
   β Idioms used in "medical" Latin.

ETYMOLOGY.

1. *The actual Meaning of the Word.*—This will be found from the ordinary dictionary: the principal medical words should, however, be carefully committed to memory.
2. *The Part of Speech.*—We must now take into consideration whether the word is a noun, pronoun, verb, &c. The nature of the properties of these divisions is learnt from the grammar of a language. We may divide them (with reference also, later on, to their terminations) into—

   I. Variable words.
   II. Invariable words.

Parts of Speech.

I. *Variable.*		II. *Invariable.*
Nouns.		Prepositions.
Adjectives.		Adverbs.
Pronouns . .	Personal. Demonstrative. Relative. Possessive.	Conjunctions. Interjections.
Verbs.		

3. *The Termination.*—This may be regarded as the most important part of the word; for a word, if capable of inflection, is, in Latin, partly *crude form*, unchangeable; partly *termination*, changeable. The word itself always has the same meaning, but it may be considered in several positions, or as viewed from more than one point; the special way in which the word in question is intended to be taken is expressed by the termination. Those parts of speech that are capable of expressing different phases of the same meaning have variable terminations; those words, on the other hand, that can be taken but in one way, as adverbs or prepositions, are invariable and not subject to inflexion. The *crude form* is obtained by cutting off, in nouns and adjectives, the termination of the ablative singular; in verbs, the termination of the third person singular, present tense, indicative mood.

(α) There are Five *Declensions* of Substantives, distinguished by the inflection of the genitive case: 1st Declension, *-æ*; 2nd, *-i*; 3rd, *-is*; 4th, *-ûs*; 5th, *-ei*.

	1st Declension.		2nd Declension.		3rd Declension.		4th Declension.		5th Declension.	
	Sing.	*Pl.*	*Sing.*	*Pl.*	*Sing.*	*Pl.*	*Sing.*	*Pl.*	*Sing.*	*Pl.*
Nom.	-a	-æ	-us -er (-um)	-i (-a)	(*various*)	-es (-a -ia)	-us	-ûs (-ua)	-es	-es
Gen.	-æ	-arum	-i	-orum	-is	-ium -um	-ûs	-uum	-ei	-erum
Dat.	-æ	-is	-o	-is	-i	-ibus	-ui	-ubus (-ibus)	-ei	-ebus
Acc.	-am	-as	-um	-os (-a)	-em -im	-es (-a -ia)	-um	-ûs (-ua)	-em	-es
Voc.	-a	-æ	-e -er (-um)	-i (-a)	(*like nom.*)	-es (-a -ia)	-us	-ûs (-ua)	-es	-es
Abl.	-â	-is	-o	-is	-e -i	-ibus	-û	-ubus (-ibus)	-e	-ebus

(β) Adjectives are of Two *Declensions*, according as they have three or two terminations in the nom. sing.

	1st Declension (like Subst. of 1st and 2nd Decl.).						2nd Declension (like 3rd Decl. of Subst.).			
	Singular.			*Plural.*			*Singular.*		*Plural.*	
	M.	F.	N.	M.	F.	N.	M. & F.	N.	M. & F.	N.
Nom.	-us (-er)	-a	-um	-i	-æ	-a	-is	-e	-es	-ia
Gen.	-i	-æ	-i	-orum	-arum	-orum	-is	-is	-ium	-ium
Dat.	-o	-æ	-o	-is	-is	-is	-i	-i	-ibus	-ibus
Acc.	-um	-am	-um	-os	-as	-a	-em	-e	-es	-ia
Voc.	-e	-a	-um	-i	-æ	-a	-is	-e	-es	-ia
Abl.	-o	-â	-o	-is	-is	-is	-i	-i	-ibus	-ibus

(*Exception.*—A few adjectives, with only one termination in the nom. sing., are declined like the nouns of the 3rd declension.)

N.B.—The comparative is formed by adding *ior*, and the superlative by adding *issimus* to the crude form.

(γ) PRONOUNS.—(*For declensions of Pronouns, personal, demonstrative, and passive, see Grammar.*) The relative pronoun *Qui* is thus declined:—

SINGULAR.	*Nom.* qui, quæ, quod	*Gen.* cujus	*Dat.* cui	*Acc.* quem, quam, quod	*Abl.* quo, quâ, quo (quî).
PLURAL.	*Nom.* qui, quæ, quæ	*Gen.* quorum, quarum, quorum	*Dat.* quibus, or queis	*Acc.* quos, quas, quæ	*Abl.* quibus, or queis.

(δ) VERBS.—There are Four *Conjugations*, or ways in which Verbs can be inflected, in the Active or Passive voices: they are distinguished by their Infinitives, which end respectively in (1) *āre;* (2) *ēre;* (3) *ĕre;* (4) *īre.*

We give the inflection, to be added to the *crude form*, of the First Conjugation; for the inflections of the other three, see Grammar.

ACTIVE.

		INDICATIVE MOOD.			SUBJUNCTIVE MOOD.		
TENSES.		1.	2.	3.	1.	2.	3.
Pres.	*S.*	-o	-as	-at	-em	-es	-et
	P.	-amus	-atis	-ant	-emus	-etis	-ent
Imp.	*S.*	-abam	-abas	-abat	-arem	-ares	-aret
	P.	-abamus	-abatis	-abant	-aremus	-aretis	-arent
1 *Fut.*	*S.*	-abo	-abis	-abit	..	..	..
	P.	-abimus	-abitis	-abunt	..	..	..
Perf.	*S.*	-avi	-avisti	-avit	-averim	-is	-it
	P.	-avimus	-avistis	-averunt (or -avēre)	-averimus	-itis	-int
Plup.	*S.*	-averam	-as	-at	-avissem	-es	-et
	P.	-averamus	-atis	-ant	-avissemus	-etis	-ent
2 *Fut.*	*S.*	-avero	-is	-it	..	..	..
	P.	-averimus	-itis	-int	..	..	..

IMPERATIVE MOOD, -a -ato; -ate -anto.

INFINITIVE MOOD.—*Pres.* -are. *Perf.* -avisse. *Fut.* -aturum esse.

PARTICIPLES.—*Pres.* -ans. *Fut.* -aturus.

GERUNDS, -andi -ando -andum.

SUPINES, -atum -atu.

PASSIVE.

		INDICATIVE MOOD.			SUBJUNCTIVE MOOD.		
TENSES.		1.	2.	3.	1.	2.	3.
Pres.	*S.*	-or	-aris	-atur	-er	-eris	-etur
	P.	-amur	-amini	-antur	-emur	-emini	-entur
Imp.	*S.*	-abar	-baris	-batur	-arer	-areris	-aretur
	P.	-abamur	-bamini	-bantur	-aremur	-aremini	-arentur
1 *Fut.*	*S.*	-abor	-beris	-bitur	..	..	..
	P.	-abimur	-bimini	-buntur	..	..	..
Perf.	*S.*	-atus sum (fui)	es	est	-atus sim (fuerim)	sis	sit
	P.	-ati sumus	estis	sunt	-ati simus	sitis	sint
Plup.	*S.*	-atus eram (fueram)	eras	erat	-atus essem (fuissem)	esses	esset
	P.	-ati eramus	eratis	erant	-ati essemus	essetis	essent
2 *Fut.*	*S.*	-atus ero (fuero)	eris	erit	..	..	..
	P.	-ati erimus	eritis	erunt	..	..	..

IMPERATIVE MOOD, -are -ator; -amini -antor.

INFINITIVE MOOD—*Pres.* -ari. *Perf.* -atum esse (fuisse). *Fut.* -atum iri.

PARTICIPLES.—*Perf.* -atus. *Fut.* -andus.

SYNTAX.

I. **Simple Construction,** as between two words, comprehending the cases where one word depends for its termination on its being governed by another: the governed word may or may not agree with the governing word.

(α) CONCORD, or agreement between two words.

1. The verb agrees with its nominative case—

In number (plural or singular).
In person (first, second, or third).

EXAMPLE.—Fiant pulveres.
Let powders be made.

a. This nominative case may be a noun, pronoun, or adjective with noun *understood*; or it may be a pronoun *understood*.

Example.—Pilulæ, quarum capiat unam nocte (*homo* or *æger* understood).
Pills, of which let the patient take one at bedtime.

b. Two nouns singular take a verb plural.

Example.—Misce, ut fiant enema et injectio.
Mix, that an enema and an injection may be produced.

2. The adjective agrees with its substantive—

In number (singular or plural).
In case (nominative, genitive, dative, &c.).
In gender (masculine, feminine, or neuter).

Example.—Post singulas dejectiones liquidas.
After each attack of diarrhœa.

a. Two nouns singular take an adjective (or participle used in the sense of an adjective) plural.

Example.—Fiant mistura et pilula, quotidie sumendæ.
Make a mixture and a pill, to be taken daily.

3. The relative (pronoun) agrees with its antecedent—

In gender.
In number.
In person.

Example.—Fiat mistura, quæ mane nocteque sumenda est.
Make a mixture, which is to be taken morning and night.

a. It takes its case from the verb in its own clause: it is in the *nominative* when it is the subject, but in the *accusative* (or dative, &c.) when the object of the verb.

Example.—Fiat mistura, cui adde aquæ unciam.
Make a mixture, to which add an ounce of water.

b. It is in the neuter gender when it refers to a whole clause.

Example.—Divide in partes equales, quod primum est omnium.
Divide it into equal parts, which is the most important thing.

(The first clause is the antecedent to *quod*, meaning, that the equal division is the most important thing.)

(*β*) GOVERNMENT, of one word by another.

1. *Nouns.*

a. Of two nouns referring to the same person or thing, both are in the same case, the second by *apposition*.

Example.—Fiat pulvis (bacca contrita).
Let a powder (a bruised berry) be made.

b. Of two nouns, referring to different objects, the second is in the genitive.

Example.—Mucilago acaciæ.
Mucilage of gum arabic.

c. Occasionally an adjective in the neuter gender is followed by a genitive.

Example.—Paululum hujus misturæ.
A little of this mixture.

d. *Opus, usus,* and nouns of necessity govern the ablative case of the thing wanted, and the dative case of the person or thing to or for which it is wanted.

Example.—Si ægro balneo calido opus sit (*ægro* in dative, *balneo* in ablative).
If it is necessary to give a warm bath to the patient, or *if a warm bath is necessary for the patient.*

2. *Adjectives.*

a. Adjectives of desire, fear, knowledge, govern the genitive case.

Example.—Timidus febris.
Afraid of fever.

b. Words denoting a part are followed by a genitive. (See also above.)

Example.—Pulveris dimidium.
Half the powder.

c. Adjectives of advantage, fitness, relation to, followed in English by the words *to* or *for*, take a dative.

Example.—Unguenta, ulceribus utilis.
The ointment, useful for ulcers.

d. *Dignus, indignus, natus,* &c., take an ablative.

Example.—Mistura digna honore.
A mixture worthy of honour.

3. *Pronouns,* as nouns.

4. *Verbs.*—The general rule with respect to the cases of verbs is that the primary object of a transitive verb, the object on which the action of the verb *directly* passes, is in the *accusative*; the secondary object, to or for which the action of the verb takes place, is put in the *dative* case; the tertiary, or more remote object (from which the action proceeds, &c.), which occurs with certain verbs and in certain clauses, is in the *ablative* case.

When the *genitive* case occurs, it almost invariably conveys the idea of either possession or partition of some kind.

a. Of two verbs coming together, the second is placed in the infinitive mood.

Example.—Mistura quam debet capere æger.
A mixture which the patient ought to take.

b. The ordinary active transitive verb, or *attribute* of the sentence, is followed by the accusative case of its object; passive verbs, of course, can have no primary object.

Example.—Capiat æger duas pilulas.
Let the patient take the two pills.

c. Intransitive verbs of existence (as *sum, esse*) are followed by the same case that precedes them, generally the nominative. When this occurs, the subject and object may be considered as in *apposition.*

Example.—Pilula hæc, quæ est pulvis cum aquâ.
This pill, which is a powder and water.

d. Verbs of compassing, giving, taking away, are followed by the dative case; also those verbs compounded with the prepositions, *ad, con, in, ob, pre, sub, super.*

Example.—Affricetur unguenta brachiis.
Let the ointment be rubbed into the arms.

e. *Utor,* also the participles *natus, editus,* &c., govern the ablative case.

Example.—Utatur balneo frigido.
Let (the patient) make use of a cold bath.

5. *Prepositions.*—Those that imply motion *towards* are generally followed by the accusative; those that signify *rest,* or motion *from,* govern the ablative.

a. ***Ad, in*** (with motion), &c., take the accusative.

Examples.—Injectio, quæ in urethram injiciatur.
The injection, which is thrown into the urethra.

Ad medium brachium.
On the middle part of the arm.

b. ***Ab, de, ex*** (*e*), *pro,* ***in*** (with rest), take the ablative.

Examples.—Acus, in vulnere relictus.
A needle, left in the wound.

In pulvere.
In powder.

c. The agent, after a passive verb, is expressed by the ablative case; often with *a* or *ab.*

Example.—Ab emplastro lyttæ.
From (or by) cantharides plaister.

d. The matter, or materials of which a thing is made, is signified by *e* or *ex* with the ablative.

Example.—Emplastrum, e lyttâ factum.
Plaister, made from cantharides.

6. *Adverbs.*—Adverbs of time (1), quantity (2), and place (3)—answering to the questions, How long? (1), How much? (2), and Where? (3)—are followed by the genitive case.

Examples.—(1) Tunc diei.
At that time in the day.

(2) Tantum pulveris.
So much powder.

7. *Conjunctions.*—These couple like cases (of nouns) and like moods (of verbs).

Example.—In pulverem misturamque oleum mitte.
Put the oil into the powder and the mixture.

II. **Compound Construction.**—This comprehends the construction of sentences and the government of "dependent" clauses.

Sentences are either—

1. Principal.
2. Subordinate.

These subordinate sentences may have the verb (*a*) in the infinitive, with the accusative of the subject; (*b*) in the subjunctive, with *ut, si, donec,* &c., implying contingency, doubt, &c.; (*c*) in the indicative, when a simple statement of facts is intended.

a. A dependent clause, with the meaning that a thing is taking place, is expressed by an infinitive of the verb with an accusative of the subject: this construction is used where the clause contains a simple statement of facts, without any circumstances dependent for their completion or effect on the principal sentence; it is used, therefore, after verbs of learning, knowing, believing, &c., and in general after verbs of information, and after those expressing the acts of the mind or of the senses; it is generally also used to convey the idea of circumstances or explanation.

EXAMPLE.—Mistura sumenda est, cum constet *vires deficere.*
The mixture is to be taken when (or since) *it is perceived that fainting is coming on.*

b. The construction, in a dependent sentence, of the subjunctive with *ut* (that), *ne* (lest), *si* (if), *donec* (until), *cum* (when), and other particles, is made use of when doubt or condition is intended to be implied.

It conveys the meaning of contingency, or effect, motive, hesitation, dependence, on the principal clause. *That,* followed by *may* or *might,* and with the following meanings, is expressed in Latin by *ut,* with the subjunctive; in negative sentences, *that, not,* or *lest,* is translated by *ne.*

α Wish, request, command.
β Design, purpose, intention.
γ Result, conclusion, effect.

EXAMPLES.—Misce, ut fiat mistura ut liquor injiciatur
Mix, in order to make a mixture, that the liquid may be injected

donec leniatur dolor nisi alvus prius responderit si opus sit.
until the pain diminishes, unless the bowels have been open, if it is necessary.

Cum or *quum,* meaning, *since, although,* takes, in the subordinate clause, the subjunctive mood.

EXAMPLE.—Mistura statim sumenda, *quum constet* vires deficere.
The mixture must be taken at once, since it is plain that the patient is fainting.

c. If the second or subordinate clause simply expresses a fact, without ideas of contingency, it may be put in the indicative; however, in most cases of this kind, the accusative and infinitive is a more elegant way of giving the same significance.

d. The verb of a clause may be often elegantly expressed by a *participle* agreeing, as an adjective, with its substantive. This is especially the case with clauses expressing the intention, when the participle in *udus* is made use of, denoting fitness, necessity, or something intended: often the preposition *ad,* with the neuter participle (or gerund in *dum*) is used.

EXAMPLE.—Ad alvum excitandum.
To bring on purging.

One of two clauses, in English, is often turned in the Latin construction into a participle agreeing with the object of the first verb.

EXAMPLE.—Solve medicamentum contritum.
Bruise and dissolve the medicine.

(α) SPECIAL FORMS OF CONSTRUCTION.

a. Ablative absolute.—In many cases a noun (or pronoun) is not connected with any word in the sentence, either as agreeing or as governed, with the exception of the participle (sometimes not expressed) with which it is associated; the words of this isolated clause are then put in the ablative; the English construction generally necessitates the use of a particle of time.

EXAMPLES.—Absente febre.
When the fever has left.

Urgente dolore.
On the pain becoming violent.

Vomitu superveniente.
When vomiting comes on.

Sevo adipeque simul liquefactis.
After having melted together the suet and the lard.

b. Nouns expressing cause (1), manner (2), or instrument (3), answering respectively to the questions, Why? How? and By what means?

EXAMPLES.—(2) More solito.
In the usual way.

(3) Curetur unguento sabinæ.
Let it be dressed with savine ointment.

c. Words expressing *point of time* (When?) are put in the ablative; expressing *duration of time* (How long?) in the accusative.

EXAMPLES.—Singulis noctibus.
Every night.

Horâ somni.
At bedtime.

Noctem.
All night long.

d. Comparison is implied by the ablative of the person or thing to which another is compared.

EXAMPLE.—Emplastrum lyttæ unguento melius.
The cantharides plaister is preferable to the ointment.

(β) FORMS OF CONSTRUCTION PECULIAR TO PRESCRIPTIONS.

The terms and idioms used in what might be termed medical Latin can only be acquired from the careful study of actual prescriptions; several, however, of the principal ones are given in the analysis of a prescription in a subsequent division.

PART II.—The Form of a Prescription, with Examples.

The first point in dispensing, or rather the prologue to it, without which practical dispensing can have no existence, is the Prescription.

The reading and perfect comprehension, therefore, of the prescription is an ***essential*** in the consideration of the several branches of knowledge necessary to the dispenser: however, by the classification of the various points to be mastered, each, taken by itself, becomes simple and easy; and to no one more than the chemist is the division of a subject into its different heads, and their separate examination, more serviceable. He will find a subject, however difficult—a work however laborious—an instruction however complicated—unravel itself before his eyes, if one head, one division, be taken and perfectly understood before another is allowed to take up any portion of his attention. The longest day consists of many rapidly-passing seconds; the hardest subject, of a number of facts or points, each by itself easy and capable of being soon overcome. The philosopher's stone that thus simplifies the most complicated undertaking is—***system;*** a systematic division of the work in hand is the surest means to its perfect comprehension and to its rapid termination.

In the examination of prescriptions, we may divide the subject into four heads:—

1. The language.
2. The body, or main portion, comprising—
    (α) Component ingredients. (β) Quantities.
3. Directions.
4. Examples.

1. THE LANGUAGE.—Prescriptions are generally now written in Latin; owing, however, to but a limited number of words and expressions being used in their construction, this ought to offer but slight difficulty. A knowledge of the expressions (or idioms) in common use is necessary also, on account of the crabbed handwriting so often met with. To become acquainted with these set phrases, and also to acquire readiness in the reading of autograph prescriptions, a fair amount of practice is requisite: the preceding chapter on the grammatical construction of the language will give a fair insight into this subject; suffice it to say, however, that the words used are almost always abbreviated, the proper terminations being very rarely made use of in actual practice.

2. THE BODY OF THE PRESCRIPTION.—The heading is at left hand corner, ℞, or recipe. The designation of the ingredients comprises (*a*) the articles to be dispensed, and (β) the quantities of these said articles to be weighed or measured.

(α) These are either—(1) Articles of Materia Medica, in the state of nature, or powdered, &c. *Ex.* Sennæ Alexandrinæ.
Rad. rhei.
Pulv. jalap.

(2) Preparations of the Pharmacopœia. *Ex.* Potassæ acetatis.
Hyd. perchlor.
Spt. am. arom.
Tinct. opii ammon.

Potassium	Potass. iodidum	Linimentum	22 gr. to 1 fl. oz., nearly.
		,, c. sapone	54½ ,, 1 ,, ,,
		Liquor iodi	30 ,, 1 ,,
		Tinctura iodi	5½ ,, 1 ,, nearly
		Unguentum	1 part in 8¾ ,, ,,
		,, iodi	16 gr. in 1 oz. ,,
Quinia	Quin. sulphas	Tinctura	8 gr. in 1 fl. oz.
		Pilula	3 parts in 4.
		Vinum	1 gr. in 1 fl. oz.
		Ferri et quiniæ citras	16 parts quinia in 100.
Strychnia		Liquor	4 gr. in 1 fl. oz.
Veratria		Unguentum	8 gr. to 1 oz.
Aconitum	Radix	Linimentum	1 oz. to 1 fl. oz.
		Tinctura	54½ gr. to 1 fl. oz.
Camphor		Linimentum	1 in 5, nearly.
		,, camph. comp.	54½ gr. in 1 fl. oz.
		Spiritus	1 in 10.
		Tinct. camph. comp.	1½ gr. in 1 fl. oz.
Cantharis		Acetum	2 oz. to 1 pint.
		Emplastrum	1 part in 3.
		Liquor epispasticus	1 oz. in 2½ fl. oz.
		Tinctura	5½ gr. in 1 ,,
		Unguentum	1 part to 7, nearly.
Ferrum	Ferr. iodidum	Pilula	1 part in 3.
		Syrupus	4·3 grains in 1 fl. drachm.
Lobelia		Tinctura	54½ grains to 1 fl. oz.
		,, æther.	
Oleum crotonis.		Linimentum	1 volume in 8.

ζ How often to be taken	alt*ernis* hor*is*	every other hour.
	omni semihor*â*	,, half-hour.
	,, bihor*iâ*	,, two hours.
	ad tert*iam* vic*em*	thrice.
	indies, quotidie	daily.
	omn*i* hor*â*	every hour.
η When to be taken (time)	man*e* nocte*que* sum*endum*	to be taken morning and night.
	cras noct*e*	to-morrow evening.
	ad lib*itum*	whenever (the patient) chooses.
	post jent*aculum*	after breakfast.
	hor*a* sol*ita*	at the usual hour.
	hor*a* som*ni*	at bedtime.
	dieb*us* alt*ernis*	every other day.
	hod*ie* vesp*ere*	this evening.
θ When to be taken (under what circumstances)	ut (si) opus sit	as necessary—if necessary.
	pro re nat*â*	as there is occasion (for it).
	tus*si* ingrav*escente*	if the cough increases.
	post sing*ulas* sed*es* liq*uidas*	after each attack of diarrhœa.
ι Length of time to be administered	per hebdom*adem*	for the space of a week.
κ Attendant circumstances	phial*â* agit*atâ*	the bottle to be shaken (after it *has* been shaken).
λ Result intended	ad alv*i* plen*am* solut*ionem*	to relieve costiveness.
	ad vom*itum* promov*endum*	to produce vomiting.
	ad sud*ationes* dim*inuendas*	to reduce the perspiration (sweatings).

4. Examples.—We give but few examples of prescriptions, referring the student to autograph examples.

℞ Sodæ sulphat. . ℥jss
,, phosph. . ℥j
Syr. rhœados . ʒiv
Aq. cinnamom. . ℥vj
M. ʒj statim sumend. et dosis repetat. omni bihoriâ donec alvus purgetur.

℞ Tinct. hyoscyam. . ʒss
,, opii . . ʒj
Mist. cretæ . . ℥vj
M. Cochl. duo magn. ter quaterve alternis horis donec dolor leniat.

Parts of Speech.

I. *Variable.*		II. *Invariable.*
Nouns.		Prepositions.
Adjectives.		Adverbs.
Pronouns . .	Personal. Demonstrative. Relative. Possessive.	Conjunctions. Interjections.
Verbs.		

3. *The Termination.*—This may be regarded as the most important part of the word; for a word, if capable of inflection, is, in Latin, partly *crude form*, unchangeable; partly *termination*, changeable. The word itself always has the same meaning, but it may be considered in several positions, or as viewed from more than one point; the special way in which the word in question is intended to be taken is expressed by the termination. Those parts of speech that are capable of expressing different phases of the same meaning have variable terminations; those words, on the other hand, that can be taken but in one way, as adverbs or prepositions, are invariable and not subject to inflexion. The *crude form* is obtained by cutting off, in nouns and adjectives, the termination of the ablative singular; in verbs, the termination of the third person singular, present tense, indicative mood.

(*α*) There are Five *Declensions* of Substantives, distinguished by the inflection of the genitive case: 1st Declension, *-æ*; 2nd, *-i*; 3rd, *-is*; 4th, *-ûs*; 5th, *-ei*.

	1st Declension.		2nd Declension.		3rd Declension.		4th Declension.		5th Declension.	
	Sing.	*Pl.*	*Sing.*	*Pl.*	*Sing.*	*Pl.*	*Sing.*	*Pl.*	*Sing.*	*Pl.*
Nom.	-a	-æ	-us -er (-um)	-i (-a)	(*various*)	-es (-a -ia)	-us	-ûs (-ua)	-es	-es
Gen.	-æ	-arum	-i	-orum	-is	-ium -um	-ûs	-uum	-ei	-erum
Dat.	-æ	-is	-o	-is	-i	-ibus	-ui	-ubus (-ibus)	-ei	-ebus
Acc.	-am	-as	-um	-os (-a)	-em -im	-es (-a -ia)	-um	-ûs (-ua)	-em	-es
Voc.	-a	-æ	-e -er (-um)	-i (-a)	(*like nom.*)	-es (-a -ia)	-us	-ûs (-ua)	-es	-es
Abl.	-â	-is	-o	-is	-e -i	-ibus	-û	-ubus (-ibus)	-e	-ebus

(*β*) Adjectives are of Two *Declensions*, according as they have three or two terminations in the nom. sing.

	1st Declension (like Subst. of 1st and 2nd Decl.).						2nd Declension (like 3rd Decl. of Subst.).			
	Singular.			*Plural.*			*Singular.*		*Plural.*	
	M.	F.	N.	M.	F.	N.	M. & F.	N.	M. & F.	N.
Nom.	-us (-er)	-a	-um	-i	-æ	-a	-is	-e	-es	-ia
Gen.	-i	-æ	-i	-orum	-arum	-orum	-is	-is	-ium	-ium
Dat.	-o	-æ	-o	-is	-is	-is	-i	-i	-ibus	-ibus
Acc.	-um	-am	-um	-os	-as	-a	-em	-e	-es	-ia
Voc.	-e	-a	-um	-i	-æ	-a	-is	-e	-es	-ia
Abl.	-o	-â	-o	-is	-is	-is	-i	-i	-ibus	-ibus

(*Exception.*—A few adjectives, with only one termination in the nom. sing., are declined like the nouns of the 3rd declension.)

N.B.—The comparative is formed by adding *ior*, and the superlative by adding *issimus* to the crude form.

SECT. V.—**Prescriptions**—*continued.*

2. ERRONEOUS.

A prescription may contain errors in each of its parts—

(α) In the names of the ingredients.
(β) The quantities (or doses).
(γ) The directions.

(α) ERRORS IN NOMENCLATURE.

This may occur from one name being used where another article is intended; from the use of an *obsolete* name, &c.

EXAMPLE:

℞ Hyd. perchlor. gr. iv
Ext. hyoscyam. gr. ij
Pil. hyd. gr. vi
Fiant duæ pilulæ, una quâque nocte sumenda.

REMARKS:

Here is a palpable error; as prescribed, *poisonous*. It is clear, however, that *hydrargyri subchlor.* was intended; and although, if it be possible, the chemist should communicate with the writer of the prescription, yet, where this is not in his power, most authorities would consider that he would be justified in making up the pills, with the substitution of calomel for hydrargyri perchloridum.

(β) ERRORS IN QUANTITIES OR DOSES.

This may arise from the substitution of signs, as ℥ for ʒ; from forgetfulness of the full dose of an article, &c.

EXAMPLE:

℞ Zinc. chlor. gr. vi
Aquæ dest. ʒiv
Fiat inject., ter die utend.

REMARKS:

The strength is here so unusual that it seems apparent that the sign ʒ has been erroneously placed for the sign ℥. Such a prescription ought not to be made up, there being *clearly* a mistake in the quantities as prescribed.

EXAMPLE:

℞ Liq. am. acetatis ʒss
Syr. aurantii ℥ij
Liq. morph. acet. ʒiij
P.L.
Misce.

REMARKS:

The error here lies in the *substitution* of the signs. The prescriber must have intended the larger quantity to apply to the Liq. am., and the smaller (ʒ ss) to the Liq. morph. Whatever might be the directions (here they are omitted), this would be the assumption.

(γ) ERRORS IN THE DIRECTIONS.

Although an error may here occur in several different ways, yet it will generally resolve itself into a question of doses. The dispenser should note, in order that no error of sufficient importance to endanger the health of the patient should be present *undetected*—

Points to be noted.	*Examples.*
(α) That the union of the ingredients and the form of administration are perfectly safe.	Incompatibles, as acids and alkalies, in a mixture. Strong acids without sufficient diluents.
(β) That the division is correct.	Ext. opii, gr. x, might in a prescription be ordered to be divided into *two* instead of *ten* pills; if made up, one pill would be poisonous.
(γ) That the actual dose is correct.	See chapter on "Posology, or Doses."
(δ) That the administration as ordered is safe.	℞ Tinct. canthar. ℥ss Linim. sapon. ℥iss Misce. ℥ss. omni nocte sumend. Here an *external* remedy is, by mistake, ordered to be taken internally. *Utend.* would be the correct word, or even more detailed directions.
(ε) That it is not to be taken too frequently.	A large dose of opium or strychnia *omni horâ* instead of *omni die*, or *quotidie.*
(ζ) That the time of administration and attendant circumstances suit the medicine.	An emetic *ante cibum*, or a full dose of morphia *mane* instead of *nocte sumend.*

The above are the principal errors to be met with in prescriptions. If the dose be neither unusual nor erroneous, and the directions do not present any point out of the usual order, the prescription may be dispensed with complete safety.

PART IV.—**Posology.**

This division treats of the usual doses in which most medicines may safely be administered; there are, of course, exceptional cases where they may be exceeded; still, as a *general* rule, any dose for an adult exceeding those in the following tables, must be looked upon as unsafe, or even dangerous.

The following is a classification in which the examples given are those that are most likely to be met with in the majority of cases coming under notice in general practice:—

1. GRADUATED GROUPING OF DOSES.

POISONOUS.		POWERFUL.		STRONG.	
$\frac{1}{30}$ to $\frac{1}{12}$ gr.	$\frac{1}{16}$ to $\frac{1}{4}$ gr.	$\frac{1}{4}$ to $\frac{1}{2}$ gr.	1 to 3 gr.	2 to 10 gr.	10 to 30 gr.
Arsenic. Strychnia.	Hyd. iodid. Hyd. perchlor. Sodæ arsenias. Ferri arsenias. Argent. nit. Antim. tartaratum (*diaphoretic*). Elaterium.	Iodum. Ext. stramonii. Ol. croton ($\frac{1}{3}$ to 1 ♏).	Berberina. Antim. sulphur. ,, tartaratum (*emetic*). Podophylli resin ($\frac{1}{4}$ to 2 gr.). Opium ($\frac{1}{2}$ to 2 gr.). Acid. carbolic. (1 gr.). Cupri sulph. (*astringent*) ($\frac{1}{4}$ to 2 gr.).	Bismuth subnitras. Plumbi acet. Potass. iodid. Acid. tannic. Ferri et quin. citras. Hyd. c. cretâ. Cupri sulph. (*emetic*).	Potass. bromid. Ergota.
	Morph. hydrochlor. et acet.				
			Quin. sulphas. Santoninum. Hydrarg. subchlor.		

2. DOSES OF PREPARATIONS—IN CLASSES.

Articles.	*Doses.*	*Examples.*	*Exceptions.*
Powdered Drugs . .	1 gr., *powerful.* 5 to 10, *strong.* 20, *ordinary strength.*		

Aceta	60 ♏		Aquæ laur.-cerasi.	5 to 30 ♏.
Confectiones			Conf. opii.	5 to 20 gr.
Decocta	1 to 2 oz.			
Extracta	½ to 1 gr., *powerful*.	Aconit. Cannab. ind. Opium. Belladon. Nux vomic.	Ext. physostigmat. „ stramonii	1/16 to ¼ gr. ¼ gr.
Infusa	3 to 6, *strong*. 5 „ 10, *ordinary strength*. 1 to 2 oz.		Inf. digitalis	¼ to ½ oz.
Liquores			Liq. sodæ arsen. „ arsenical „ arsen. hydroch.	2 to 8 ♏.
			„ atropiæ	1 ♏.
			„ bismuth	30 to 60 ♏.
			„ hyd. perchlor.	30 to 120 ♏.
			„ morph. acet. „ „ hydroch.	10 to 60.
Olea essent.	1 to 4 ♏.			
Pilulæ	5 to 10 gr.		Pil. plumbi c. opii. „ sapon. co.	4 gr. 3 to 6 gr.
Pulveres	*as above*		Pulv. antimonialis „ opii co.	2 to 6 gr. 2 to 5 gr.
Syrupi	60 gr. to ½ oz.			
Tincturæ	5 to 20 ♏, *powerful*	Aconit. Belladonnæ. Cannab. indic. Iodi.		
	10 to 30 ♏, *very strong*	Digitalis.		
	15 to 60 ♏, *strong*	Hyoscyam. Ergota.		
	60 to ½ oz., *ordinary strength*. ½ oz., *weak*.	Rhei (*as purgative*		

SECTION VI.

PRACTICAL DISPENSING.

PART I.—**Hints on Practical Dispensing.**

THE most important of the several duties of one intending to enter life as a Pharmacist is, without doubt, Dispensing: and with reason, for it is in the making-up of prescriptions that the amount of scientific knowledge is required which elevates Pharmacy, and which, by rendering absolutely necessary a certain educational cultivation and scientific training—not required in the case of the ordinary seller of goods—places the mind on a higher level, and the man in a more refined position.

We will now consider, in detail, the *modus operandi* of the compounding of a prescription.

AXIOMS.	REMARKS.
Read the prescription throughout.	It is always advisable to go through the prescription carefully, even to the directions. By this means, *first*, a good idea of the formula as a whole is acquired; and, *secondly*, any overdose, or poisonous proportions, or the presence of incompatibles, are noticed.
See that the ingredients are at hand.	This avoids the necessity, when half through the work, of being compelled to stop while a powder, &c., is got ready. The several ingredients ought to be brought forward (or seen to be in their places) before commencing.
Examine the accessories.	The fittings of the dispensing department ought to be of the most perfect description, clean to the last degree; the bottles, scales, measures, &c., in repair, and of the kind adapted to the work on hand.
Set to work quickly.	Dispatch is necessary to good dispensing, and in its turn is much aided by neatness and a *thorough* completion of each part or division of the work on hand, before taking-up another portion. But waste no time: from the very nature of the business, there are times when an unusual number of prescriptions will have to be made up, and dispatch, at all times advisable, will then become a necessity.
Weigh and measure carefully.	The careful manipulator is above all things characterized by his method of weighing and measuring. In using a measure, hold it up to the light, so that the two lines marked on either side of the glass, at each graduated quantity, shall be in one line of sight, and the liquid at the same time exactly reaches up to these two marks.

Use the pestle gently yet firmly.	Do not pound and bring down the pestle with force (as regards composition mortars), but rather use it as a lever, and the side of the mortar as its fulcrum, pressing against and working up the material under operation. It is astonishing what an amount of force is thus brought to bear by this apparently simple method of handling the pestle.
Make sparing use of the mortar.	Only use if absolutely necessary; for pills, especially if few in number, a slab (porcelain) is preferable on every account; although, for the more intimate mixture of powders, the mortar, to be followed if necessary by the sieve, is often of service.
Judge the best order in which to mix the ingredients.	The more volatile ingredients should be added last. Ammonia or chloroform would lose a great deal if worked up in a mortar with the other ingredients of a formula. Add the bulky menstruum last, though add (in a mixture) some of the diluents before putting in a powerful acid or alkali. If extracts or powders enter into the composition of a mixture, rub them up first of all into a thin paste with a little of the liquid menstruum.
In pills, choose with judgment the best excipient.	From a knowledge of the properties of the ingredients ordered, judge if you require in the excipient,— (*a*) adhesiveness; (*b*) firmness; (*c*) plasticity, combining the above two. Often the articles have these qualities, but simply require them to be developed. For the proper excipients for each class of article, see Part II. of this Section.
For emulsions, choose specimens with much oil.	As an emulsion requires for its perfection a certain quantity of oily matter, choose Gum Myrrh, &c., with a *fatty* appearance (never powdered); Almonds, new and soft, &c.
Proceed with emulsions in a certain order.	Oil or fat intended to be suspended by means of an alkali in water is best prepared by adding the oil to about its own quantity of water, mixing intimately with the alkali, and putting to it the rest of the diluent. The mucilage, freshly made, that is generally used to suspend Copaiba, should be worked up with a few drops only at a time of the oleo-resin, and diluted with water, before each fresh addition. If there happen to be any other ingredients in the formula, the time for adding them is when the *emulsion proper* is completed.
For powders, begin with least active ingredients, &c.	The advantage of this method of procedure is that the more powerful ingredients are thus well diffused through the whole bulk of the *diluting* powder. In the division of powders, it is always preferable to weigh than simply to divide them; besides ensuring a more perfect division, it checks the presence of all the ingredients, by the discovery in such a case of (say) ten or eleven in place of twelve powders.
In finishing the preparation of a formula, do not leave behind any appreciable quantity.	See that every particle of the ingredients is as far as possible taken up; in other words, that the accessories (mortar, measures, &c.) are left clean and well scraped. From the neglect of this the unskilful dispenser will sometimes leave a pill or two in his mortar, or a couple of drops in his minim measure.
Re-peruse the prescription.	Read the prescription again carefully, and check the quantities, &c. This is a capital plan to escape serious error, by detecting and correcting any mistakes or omissions that may have arisen during the making-up of the prescription.

SECT. VI.—**Practical Dispensing**—*continued.*

AXIOMS.	REMARKS.
Finishing up.	Pay special attention to neatness in writing the directions, and in wrapping up the medicine. We may presume the mixture, &c., is correctly dispensed; there is no longer any question of *that.* We have now only to give all our attention to the presentation of the medicine under the most favourable circumstances to the patient of refined taste, or perhaps ultra-delicate nervous system. The attainment of this end requires rather negative than positive qualities. Draughts, &c., must be directed and put up with the most scrupulous neatness:—no display, no flourishes of the pen, no exhibition of parti-coloured sealing-wax; at the same time a thorough attention to details—vials of the cleanest, paper of the whitest, general finishing-off of the most perfect good taste.

PART II.—**Aids to Dispensing.**

This portion of our section will give some slight classification of various examples of pills, emulsions, &c. Although, either in emulsion or pill, almost every separate combination of ingredients might be treated in a different way, yet it will be found eminently satisfactory to divide into classes the majority of the articles of the Materia Medica; and thus, on operating with any drug, or combination of drugs or chemicals, the excipient or *modus operandi* of the class can, on the spur of the moment, be employed: and even if the article be *unusual,* or made up by the dispenser for the first time, then *that* excipient may be used which is applicable to some similar drug or chemical, or that has already been found to have been useful in a similar position or a parallel dilemma.

PILLS.

We will take into consideration, in the first place, that important class of remedies, Pills. The pill is one of the most useful of all forms for the administration of medicine; it is generally taken with facility, it can be made available for all but the more fluid drugs or preparations, it is the most convenient vehicle for the exhibition of those powerful articles of the Materia Medica that have been of late years so much in vogue, and, lastly, the effects, though sure, are generally (to the advantage of the patient) slow, and regulated by the action of the digestive powers.

Although almost all medicines may be given in this form, yet a different manipulation is required in many different cases. In the first place, three essentials are required for a pill:—

1. Firmness. 2. Adhesiveness. 3. Plasticity.

1. *Firmness.*—It is necessary that a pill should have sufficient substance; that it should be hard, firm, and solid; that it should also retain its shape for a reasonable length of time. At the same time, this quality should not be exclusively given by means of a substance possessing not only hard (*present*) but hardening (*future*) qualities; as, for example, powdered Tragacanth.
2. *Adhesiveness.*—A very necessary quality. It represents the amount of viscid tough cohesion that prevents the particles of the pill from crumbling away. It may be given to the several ingredients by the use of some excipient possessing that quality, or it may

by the addition of something, be brought out, existing already, though undeveloped, in one or more of the ingredients: for the display of adhesiveness, a state of semi-fluidity (or quasi-softness) is absolutely essential.

3. *Plasticity* is a well-balanced union of these two qualities, or, to a certain degree, opposite forces. Its presence gives the perfection of a pill-mass: sufficient softness to roll out with ease, with the firmness requisite to enable the pill to maintain its correct shape.

In order to impart these qualities to those combinations of ingredients that do not of themselves possess it, we make use of certain menstrua, inert in themselves, which we term *excipients.* These excipients are of various natures, to be used in accordance with the effect required, or the main ingredient that is to be brought to what is called a pilular consistence. In the consideration of the several excipients, we may divide them into five classes: the illustrations are intended to act also as a classification of the pills of the Pharmacopœia.

Class I.—Those articles requiring an excipient possessing both firmness and adhesiveness.

Example.	*Excipients.*
The mineral preparations of iron, mercury (calomel), lead, &c.	Confect. rosæ gall.; manna.
The aloes pills of the Pharmacopœia	Confect. rosæ gall. (with or without the addition of powdered hard soap).
Quiniæ sulphas	Confect. rosæ canin.

Class II.—Those articles requiring not so much *firmness* as moist soft *adhesiveness,* that will enable them to be built up into a pill-mass. An excipient that tends to the conservation of the article, and that does not crystallize, is in many cases advisable. Treacle fulfils all these conditions. Most powdered vegetable substances, and, in some combinations, the gum-resins, come under this head.

With articles, as jalap or rhubarb, that contain in their composition a *resin* in any quantity another treatment may be adopted. If syrup be used, add the whole quantity *at once,* to prevent the probable formation of a hard mass; but frequently glycerine, water, or weak spirit, may be used with advantage: *size* is reduced, though at the expense of plasticity.

Examples.	*Excipients.*	
Ipecacuanha	Treacle.	Water.
Rhubarb, as in *pil. rhei comp.*	Syrup.	Proof spirit.
The gum-resin in *pil. assafœtid. comp.*	Glycerine.	
The ingredients in *pil. scillæ comp.*	Treacle and powdered soap.	

Class III.—Those articles requiring, not adhesiveness alone, but essentially *firmness.*

N.B.—It is often advisable, if the ingredients are of themselves, or when put together (in combination or in process of preparation), sufficiently moist or soft, to add, for instance, instead of treacle, &c., powdered sugar, or sugar and powdered liquorice. This has often even *increased* conservative effect.

Example.	*Excipient.*
Iodide of iron in *pil. ferri iodidi*	Powdered sugar; liquorice-root.
Opium in *pil. saponis co.*	Powdered soap; water.

Sect. VI.—**Practical Dispensing**—*continued.*

Class IV.—Those articles requiring special methods of manipulation.

Articles.	*Excipients.*
(α) Resins and gum-resins.	
Gum-resins, as aloes	Alkalies, as carb. potash (as in *dec. aloes co.* for *aloes*), often with water.
Resins, as in *pil. coloc. comp.*	Spirit; soap. Mucilage.
(β) Oils and oleo-resins.	
Copaiba (oleo-resin)	Magnesia, its weight of carbonate, or $\frac{1}{16}$ of calcined. Soap and magnesia.
Volatile oils	Crumb of bread, &c., &c.
(γ) Articles of a fatty nature.	
Unguentum hydrargyri	Calcis phosphas.
(δ) Exceptional cases.	
A resin, with mineral powders, as in *pil. hyd. subchlor comp.*	Some fixed oil, as castor oil.
Ol. croton, argent. nit.	Crumb of bread.
Pepsine, benzoic acid, &c.	Glycerine.
Kreosote	Magnesia and soap (very little).

EMULSIONS.

An emulsion is the name given to the suspension of an oily, resinous, or fatty substance in a watery liquid, by means of some fluid having the property of dividing and surrounding the particles of oil, &c., which thus remain in a suspended state. Milk is a good example of a natural emulsion. Their perfect preparation is in practical pharmacy a matter of much importance; and although care is necessary, yet success can generally be insured by attention being paid to the right method of manipulation. A good emulsion may be made by mixing intimately some fixed oil with about one-sixth its quantity of solution of potash and with its own quantity of water. A milky liquid is the result, to which the necessary amount of water (six or seven times the quantity of oil) may now be added.

The following are some of the ordinary excipients used in their preparation:—

Articles.	*Excipients.*
1. Gum-resins, as myrrh, ammoniacum, &c., as in *mistura ammoniaci* . .	Water.

The simple working-up with water is sufficient to effect, by means of the gum, the suspension of the resin; thus recurring to their actual state when in the latiferous vessels of the plant.

Resins, as guaiacum in *mistura guaiaci*	Sugar and powdered acacia gum.
Almonds, &c., as in *mistura amygdalæ*	Water.
2. Copaiba (oleo-resin) . . . . Some fixed oils, as ol. ricini . . . . Sometimes gum-resins, as assafœtida	Mucilage.

Proceed as in the instructions in the first part of this Section.

3. Fixed oils, as oleum amygdalæ, &c.	Alkali (as liq. potassæ).
4. Scammony, as in *mistura scammonii*	Milk.
Resin of jalap	Almonds or almond emulsion.
5. Bals. Peru, turpentine, solid fats, cetaceum, occasionally fixed oils, as castor oil	Yolk of egg. (N.B.—1 oz. ol. ricini is sufficiently suspended with one egg's yolk.)

In concluding this second portion of our work, let us assure all students that *dispensing*, carried to perfection, ever requires sound judgment, a quick eye, and a thoroughly well-practised hand. These are the qualities that, combined together, infallibly command success.

PART III.—**Strength of Solutions.**

The proportion in which the active principle, or more powerful ingredient, is contained in a preparation gives its strength; this may then be determined either by the powerful nature of the essential constituent, or by the quantity of the active drug contained in the preparation. We will now give a glance at the principal classes of the Pharmacopœia, fourteen in number.

1. Decocta . The proportion of active ingredients to the whole varies from 1 in 8 to 1 in 20 (in one, 1 in 120).

Dec. sarzæ, Dec. sarzæ comp.	1 in 8.	Dec. taraxaci	1 in 20.
,, papaveris . . .	1 ,, 10.	,, aloes comp. . . .	1 ,, 120.
,, cinchon. flav. . .	1 ,, 16.		

SECT. VI.—Practical Dispensing—*continued.*

2. Emplastra The proportion varies from 1 in 2 to 1 in 11 (in one, 1 in 25).

Emp. belladon. . . .	1 in 2.	Emp. hydrarg.	1 in 3⅔.
,, cantharid. . .	1 ,, 3.	,, opii	1 ,, 10.
,, calefaciens . .	1 ,, 25 (cantharides).	,, galbani	1 ,, 11.

3. Extracta . No definite proportions can be given for the majority of extracts, as a fixed quantity of any drug gives a variable amount of extract, according to its richness at the time in extractive matter.

EXAMPLES:

Ext. aloes Barb. . .	3 parts extract from 4 of aloes.
,, ,, Soc. . .	2 ,, from 4.
,, cinchon. flav. liquid	1 part extract is equal to 4 of bark.
,, coloc. comp. . .	3 parts ,, contain 1½ aloes and ½ scammony.
,, ergotæ liquid .	1 part in 1.
,, jalapæ . . .	1 ,, extract from 2 root.
,, opii . . .	1 ,, ,, ,, 2 of opium.
,, sarzæ liquid. .	1 ,, ,, contains 2 of root.

4. Infusa . Generally contain ¼ oz. to ½ oz. of the article to 10 fl. oz. water. Inf. digitalis has 30 gr., and inf. sennæ 1 oz. to 10 fl. oz. of water.

5. Linimenta. The proportion of active ingredient varies from 1 in 1 to 1 in 10 (in one, 1 in 40).

Lin. sinapis comp. . . .	1 in 40.	Lin. camphor . . .	1 in 5.
,, aconiti . . .	1 ,, 2.	,, crotonis . . .	1 ,, 8.
,, belladon. . . .		,, opii	1 ,, 2 (tinct. opii).

6. Liquores . The proportion of active ingredient in "liquors" varies considerably. The more important ones are mentioned under the special names of the articles in the preceding section.

EXAMPLES:

Liq. arsenicalis.
,, arsenici hydroch.
,, atropiæ.
,, ,, sulph.
,, epispasticus.

Liq. hydrarg. perchlor. (½ gr. in 1 oz.).
,, morph. acet.
,, ,, hydrochlor.
,, plumbi subacetatis.
,, sodæ arseniatis.
,, strychniæ.

7. Misturæ . Great variation in proportions.

8. Pilulæ . Variation from 1 (of active ingredient) in 2 (of mass) to 1 in 8. The average is 1 in 3 to 1 in 5.

EXAMPLES:

Pil. aloes Soc. . . .	1 in 2.	Pil. hydrarg. . . .	1 in 3.
„ cambogiæ comp. . .	1 „ 6, nearly.	„ quiniæ . . .	3 „ 4.
„ ferri iodid. . . .	1 „ 3.	„ saponis co. . . .	1 „ 5 (opium).

9. Pulveres . The amount of the principal article is, in a given quantity of almost each powder, different. The more important are already given, under the respective heads of Antimony and Opium, in a former table.

10. Spiritus . The proportion in those consisting of a solution of an essential oil in spirit is 1 in 50.

Spiritus armoraciæ co. .	1 in 8.
„ camphoræ . .	1 „ 10.
„ chloroformi . .	1 „ 20.

11. Syrupi . As examples of their several different strengths, we may give:—

Syr. aurantii . .	1 in 8 (tinct.)	Syr. papaveris .	1 in 2¼ (capsules).
„ limonis . .	1 „ 2 (juice).	„ scillæ .	1 „ 17.

12. Tincturæ . The chief tinctures may be classed as follows, from the *nature* of their principal ingredient, or the *amount* of active principle they contain in a given quantity.

The proportion of active ingredient in the whole is:—

(α) 1 in 2.	(β) 1 in 4.	(γ) 1 in 5.	(δ) 1 in 8.	(ε) 1 in 10.	(ζ) 1 in 13⅓.
Zingiber. fortior.	Ergotæ. Ferri perchlor (liquor).	Cinchon. flav.	*The greater number:* Aconiti. Colchic. sem. Digitalis. Hyoscyam. Jalapæ.	Benzoini comp. Cinchon. comp. Nuc. vomic. Rhei.	Opii.

(η) 1 in 20.	(θ) 1 in 40.	(ι) 1 in 60.	(κ) 1 in 80.	(λ) *Weak.*
Arnicæ. Belladon. Cannab. ind. (ext.)	Aloes. Iodi.	Quiniæ.	Cantharid. Cardam. co.	Lavand. comp. 1 in 213 (*oil*). Opii am., 1 in 100.

[illegible] VI. Practical Dispensing—*continued.*

13. Unguenta . . Of various strengths. The strengths of the important ointments will be found in a preceding table, under the various heads of

[illegible] Opium.
[illegible] Hydrargyrum.
[illegible] Plumbum.
[illegible] Veratria.

The general strength is about 1 in 10 to 1 in 20; alkaloids, 8 gr. to 1 oz.

14. Vina . Of several different proportions, according to strength of active ingredients:—

Vin. antimon. . .	2 gr. to 1 fl oz.	Vin. ipecac. . .	1 to 20.
,, ferri cit. . .	8 ,, 1 ,,	,, opii . . .	1 ,, 20 (ext.)
,, quiniæ . .	1 ,, 1 ,,		

PART IV.—**Changes in Mixtures.**

By this we mean the alteration that takes place in medicines during or after preparation. The medicine offers another appearance after a little time to that which it presented immediately on being made up.

This may result from—

(*a*) Chemical decomposition, or the formation of new definite substances.

(*b*) Fermentation, of various kinds; fungoid growths, especially among vegetable preparations.

These changes may be either—

(1) After some lapse of time, *i.e.*, a *gradual* chemical change; or

(2) Immediately, by decomposition, as on the mixing together of "incompatibles."

In both cases the student must have his knowledge of primary analysis at his fingers' ends: he must consider, of several articles to be made up together, whether they are likely to change their composition in a short time (1), or whether they are of incompatible nature, *i.e.*: reacting immediately (2) on each other.

(1) In this division of the subject we will give a few examples:—

Mixture.	*Change.*
Potassium Iodide and Decoction of Barley (Dec. Hordei).	If kept for a length of time, fermentation would be likely to arise in the barley decoction, an acid product would be produced likely to affect the potassium iodide, and on the smallest quantity being decomposed the free iodine would instantly produce a blue colour with the starch of the barley.
Solution of tartarized Antimony	A fungoid growth (or "mould," so called), peculiar to tartaric acid solutions, will appear, and on further keeping the tartaric compound would be useless as a medicine, and its nature partially or wholly altered.
Tannic Acid and Silver Nitrate in Pills . .	Decomposition will ensue, with production of gallic acid and carbonic acid. The presence of the latter causes the pills to swell up in size and appearance.
Preparations of Iron Protoxide (ferrous oxide) .	These, by absorption of oxygen, become *persalts*, or ferric salts, and change in colour. A mixture containing iron (ferrous) carbonate, as a white precipitate, rapidly becomes brown by the formation of iron peroxide (ferric oxide). Sugar hinders to a great extent this absorption of oxygen; hence its value in saccharated carbonate (proto) of iron (ferrous carbonate).
Sparkling Wines	These are good examples of the principle in question. Champagne effervesces from the presence of carbonic acid, but the wine does not contain carbonic acid at the time that it is bottled: it contains simply an excess of sugar. Now in the process of fermentation sugar changes to alcohol and carbonic acid; or rather the atoms forming the molecules of sugar split up, and form the above-named alcohol and carbonic acid. This process occurs in a bottle of champagne after bottling, and hence the presence of carbonic acid in the wine.

(2) *Incompatibles.*—Here is an extensive field for the exercise of practical chemical knowledge. We give a few examples, which might be indefinitely multiplied.

Incompatibles.	*Reasons.*
Citric Acid; and Tartrate of Potash, though the former may be presented with almost all other salts of potash.	A precipitate of acid potassium tartrate (bitartrate) would be the result.
Tartarized Antimony; and most vegetable infusions and decoctions, as Catechu, Cinchona.	Vegetable astringents throw down antimony oxide as an insoluble precipitate.
Lead Acetate; and Citric Acid	Lead citrate is one of the few insoluble citrates.
,, ,, ,, Sulphuric Acid	Lead sulphate is a very insoluble precipitate.

Incompatibles.	*Reasons.*
The Protosalts of Iron; and the Alkalies, as Potassium Oxide, Ammonia Sesquicarbonate (so called), or Ammonium Carbonate.	Owing to formation of insoluble peroxide; but the ammonium citrate and potassium tartrate are exceptions to this incompatibility.
Potassium Iodide; and Acids or Metallic Salts	Decomposition would ensue, owing to instability of the compounds.
Magnesium Sulphate; with Sodium Carbonate; but it is compatible with Sodium Bicarbonate.	A white precipitate of magnesium carbonate is formed in the first instance; in the second case, a *soluble* magnesium bicarbonate is produced.
Lead Acetate; with Sodium Phosphate or "tartarized Soda"	A white precipitate in either instance.
Ammonium Carbonate; with Lime (calcium oxide)	Formation of precipitate; but ammonium carbonate is compatible with magnesia (magnesium oxide).
Ammonium Chlorate, or Ammonia; with Magnesia	
Magnesium Sulphate; and Potassium or Sodium Oxides, and their Carbonates.	White precipitate or cloudiness.
Lead Diacetate; with Alum, Borax	Decomposition of compound, and substitution of weaker by stronger acid.
Tartarized Iron; with Mucilage	
Strong Acids; with weaker Acids, as Carbonates, Acetates	
Zinc Sulphate; with Alkalies	
Tincture of Iron Perchloride; and Mucilage of Acacia	Black iron tannate.
" " " " tartarized Iron; with vegetable astringents	

The usual reactions in chemical analysis must be remembered; of course, what are used as reagents are of necessity incompatible with salts of the bases or acids which they precipitate: thus, the soluble salts of mercury are incompatible with potassium iodide; lead salts with soluble sulphates; and quinine or morphia with an ammoniacal preparation.

Examples of Changes in Mixtures in Prescriptions.

(α) ℞ Potassæ bicarbon. ʒ jss
Syrupi simplicis ℥ ss
Sp. ætheris nitrosi ʒ ij
Acidi tartarici ʒ ij
Acidi hydrocyan. med. gtt. xx
Aqua destil. ad ℥ viij

M. Cap. coch. ij mag. 4tis vel 6tis horis.

Remark:

Here we have an example of the formation of an insoluble precipitate, the potassium bitartrate, or cream of tartar. If the *sodium* salt had been prescribed, this would not have occurred.

(β) ℞ Plumbi acetatis
Zinci sulphatis āā ℈ ij
Aq. rosæ ℥ vj

M. Ft. lotio, ter die injiciend.

Remark:

An insoluble sulphate of lead is formed and deposited; not desirable in an injection.

(γ) ℞ Sodæ bicarbon. ʒ vj
Acid. hydrocyan. dil. ♏xxx
Syr. zingiberis ʒ iij
Tinct. calumbæ ʒ iij
Infus. gentian. co. ad ℥ vj

Misce. Coch. j mag. bis in die sumend.

Remark:

This is an example of the modern folly of excessive concentration in mixtures. A portion of the salt here remains undissolved, owing to a large dose of soda in too little fluid.

AXIOMS.	REMARKS.
Finishing up.	Pay special attention to neatness in writing the directions, and in wrapping up the medicine. We may presume the mixture, &c., is correctly dispensed; there is no longer any question of *that*. We have now only to give all our attention to the presentation of the medicine under the most favourable circumstances to the patient of refined taste, or perhaps ultra-delicate nervous system. The attainment of this end requires rather negative than positive qualities. Draughts, &c., must be directed and put up with the most scrupulous neatness:—no display, no flourishes of the pen, no exhibition of parti-coloured sealing-wax; at the same time a thorough attention to details—vials of the cleanest, paper of the whitest, general finishing-off of the most perfect good taste.

PART II.—**Aids to Dispensing.**

This portion of our section will give some slight classification of various examples of pills, emulsions, &c. Although, either in emulsion or pill, almost every separate combination of ingredients might be treated in a different way, yet it will be found eminently satisfactory to divide into classes the majority of the articles of the Materia Medica; and thus, on operating with any drug, or combination of drugs or chemicals, the excipient or *modus operandi* of the class can, on the spur of the moment, be employed: and even if the article be *unusual*, or made up by the dispenser for the first time, then *that* excipient may be used which is applicable to some similar drug or chemical, or that has already been found to have been useful in a similar position or a parallel dilemma.

PILLS.

We will take into consideration, in the first place, that important class of remedies, Pills. The pill is one of the most useful of all forms for the administration of medicine; it is generally taken with facility, it can be made available for all but the more fluid drugs or preparations, it is the most convenient vehicle for the exhibition of those powerful articles of the Materia Medica that have been of late years so much in vogue, and, lastly, the effects, though sure, are generally (to the advantage of the patient) slow, and regulated by the action of the digestive powers.

Although almost all medicines may be given in this form, yet a different manipulation is required in many different cases. In the first place, three essentials are required for a pill:—

1. Firmness. 2. Adhesiveness. 3. Plasticity.

1. *Firmness.*—It is necessary that a pill should have sufficient substance; that it should be hard, firm, and solid; that it should also retain its shape for a reasonable length of time. At the same time, this quality should not be exclusively given by means of a substance possessing not only hard (*present*) but hardening (*future*) qualities; as, for example, powdered Tragacanth.

2. *Adhesiveness.*—A very necessary quality. It represents the amount of viscid tough cohesion that prevents the particles of the pill from crumbling away. It may be given to the several ingredients by the use of some excipient possessing that quality, or it may,

by the addition of something, be brought out, existing already, though undeveloped, in one or more of the ingredients: for the display of adhesiveness, a state of semi-fluidity (or quasi-softness) is absolutely essential.

3. *Plasticity* is a well-balanced union of these two qualities, or, to a certain degree, opposite forces. Its presence gives the perfection of a pill-mass: sufficient softness to roll out with ease, with the firmness requisite to enable the pill to maintain its correct shape.

In order to impart these qualities to those combinations of ingredients that do not of themselves possess it, we make use of certain menstrua, inert in themselves, which we term *excipients*. These excipients are of various natures, to be used in accordance with the effect required, or the main ingredient that is to be brought to what is called a pilular consistence. In the consideration of the several excipients, we may divide them into five classes: the illustrations are intended to act also as a classification of the pills of the Pharmacopœia.

Class I.—Those articles requiring an excipient possessing both firmness and adhesiveness.

Example.	*Excipients.*
The mineral preparations of iron, mercury (calomel), lead, &c.	Confect. rosæ gall.; manna.
The aloes pills of the Pharmacopœia	Confect. rosæ gall. (with or without the addition of powdered hard soap).
Quiniæ sulphas	Confect. rosæ canin.

Class II.—Those articles requiring not so much *firmness* as moist soft *adhesiveness*, that will enable them to be built up into a pill-mass. An excipient that tends to the conservation of the article, and that does not crystallize, is in many cases advisable. Treacle fulfils all these conditions. Most powdered vegetable substances, and, in some combinations, the gum-resins, come under this head.

With articles, as jalap or rhubarb, that contain in their composition a *resin* in any quantity another treatment may be adopted. If syrup be used, add the whole quantity *at once*, to prevent the probable formation of a hard mass; but frequently glycerine, water, or weak spirit, may be used with advantage: *size* is reduced, though at the expense of plasticity.

Examples.	*Excipients.*	
Ipecacuanha	Treacle.	Water.
Rhubarb, as in *pil. rhei comp.*	Syrup.	Proof spirit.
The gum-resin in *pil. assafœtid. comp.*	Glycerine.	
The ingredients in *pil. scillæ comp.*	Treacle and powdered soap.	

Class III.—Those articles requiring, not adhesiveness alone, but essentially *firmness*.

N.B.—It is often advisable, if the ingredients are of themselves, or when put together (in combination or in process of preparation), sufficiently moist or soft, to add, for instance, instead of treacle, &c., powdered sugar, or sugar and powdered liquorice. This has often even *increased* conservative effect.

Example.	*Excipient.*
Iodide of iron in *pil. ferri iodidi*	Powdered sugar; liquorice-root.
Opium in *pil. saponis co.*	Powdered soap; water.

SECT. VI.—**Practical Dispensing**—*continued.*

CLASS IV.—Those articles requiring special methods of manipulation.

Articles.	*Excipients.*
(α) Resins and gum-resins.	
Gum-resins, as aloes	Alkalies, as carb. potash (as in *dec. aloes co.* for *aloes*), often with water.
Resins, as in *pil. coloc. comp.*	Spirit; soap. Mucilage.
(β) Oils and oleo-resins.	
Copaiba (oleo-resin)	Magnesia, its weight of carbonate, or $\frac{1}{16}$ of calcined. Soap and magnesia.
Volatile oils	Crumb of bread, &c., &c.
(γ) Articles of a fatty nature.	
Unguentum hydrargyri	Calcis phosphas.
(δ) Exceptional cases.	
A resin, with mineral powders, as in *pil. hyd. subchlor comp.*	Some fixed oil, as castor oil.
Ol. croton, argent. nit.	Crumb of bread.
Pepsine, benzoic acid, &c.	Glycerine.
Kreosote	Magnesia and soap (very little).

EMULSIONS.

An emulsion is the name given to the suspension of an oily, resinous, or fatty substance in a watery liquid, by means of some fluid having the property of dividing and surrounding the particles of oil, &c., which thus remain in a suspended state. Milk is a good example of a natural emulsion. Their perfect preparation is in practical pharmacy a matter of much importance; and although care is necessary, yet success can generally be insured by attention being paid to the right method of manipulation. A good emulsion may be made by mixing intimately some fixed oil with about one-sixth its quantity of solution of potash and with its own quantity of water. A milky liquid is the result, to which the necessary amount of water (six or seven times the quantity of oil) may now be added.

The following are some of the ordinary excipients used in their preparation:—

Articles.	*Excipients.*
1. Gum-resins, as myrrh, ammoniacum, &c., as in *mistura ammoniaci* . .	**Water.**
The simple working-up with water is sufficient to effect, by means of the gum, the suspension of the resin; thus recurring to their actual state when in the latiferous vessels of the plant.	
Resins, as guaiacum in *mistura guaiaci*	**Sugar and powdered acacia gum.**
Almonds, &c., as in *mistura amygdalæ*	**Water.**
2. Copaiba (oleo-resin) . . . . Some fixed oils, as ol. ricini . . . . Sometimes gum-resins, as assafœtida	**Mucilage.**
Proceed as in the instructions in the first part of this Section.	
3. Fixed oils, as oleum amygdalæ, &c.	**Alkali (as liq. potassæ).**
4. Scammony, as in *mistura scammonii*	**Milk.**
Resin of jalap	**Almonds or almond emulsion.**
5. Bals. Peru, turpentine, solid fats, cetaceum, occasionally fixed oils, as castor oil	**Yolk of egg. (N.B.—1 oz. ol. ricini is sufficiently suspended with one egg's yolk.)**

In concluding this second portion of our work, let us assure all students that *dispensing*, carried to perfection, ever requires sound judgment, a quick eye, and a thoroughly well-practised hand. These are the qualities that, combined together, infallibly command success.

PART III.—Strength of Solutions.

The proportion in which the active principle, or more powerful ingredient, is contained in a preparation gives its strength; this may then be determined either by the powerful nature of the essential constituent, or by the quantity of the active drug contained in the preparation. We will now give a glance at the principal classes of the Pharmacopœia, fourteen in number.

1. Decocta . The proportion of active ingredients to the whole varies from 1 in 8 to 1 in 20 (in one, 1 in 120).

Dec. sarzæ, Dec. sarzæ comp.	1 in 8.	Dec. taraxaci	1 in 20.
„ papaveris . . .	1 „ 10.	„ aloes comp. . . .	1 „ 120.
„ cinchon. flav. . .	1 „ 16.		

2. Emplastra

The proportion varies from 1 in 2 to 1 in 11 (in one, 1 in 25).

Emp. belladon.	1 in 2.	Emp. hydrarg.	1 in 3⅔.
,, cantharid.	1 ,, 3.	,, opii	1 ,, 10.
,, calefaciens	1 ,, 25 (cantharides).	,, galbani	1 ,, 11.

3. Extracta

No definite proportions can be given for the majority of extracts, as a fixed quantity of any drug gives a variable amount of extract, according to its richness at the time in extractive matter.

EXAMPLES:

Ext. aloes Barb.	3 parts extract from 4 of aloes.
,, ,, Soc.	2 ,, from 4.
,, cinchon. flav. liquid	1 part extract is equal to 4 of bark.
,, coloc. comp.	3 parts ,, contain 1½ aloes and ½ scammony.
,, ergotæ liquid	1 part in 1.
,, jalapæ	1 ,, extract from 2 root.
,, opii	1 ,, ,, ,, 2 of opium.
,, sarzæ liquid.	1 ,, ,, contains 2 of root.

4. Infusa

Generally contain ¼ oz. to ½ oz. of the article to 10 fl. oz. water. Inf. digitalis has 30 gr., and inf. sennæ 1 oz. to 10 fl. oz. of water.

5. Linimenta.

The proportion of active ingredient varies from 1 in 1 to 1 in 10 (in one, 1 in 40).

Lin. sinapis comp.	1 in 40.	Lin. camphor	1 in 5.
,, aconiti	1 ,, 2.	,, crotonis	1 ,, 8.
,, belladon.		,, opii	1 ,, 2 (tinct. opii).

6. Liquores

The proportion of active ingredient in "liquors" varies considerably. The more important ones are mentioned under the special names of the articles in the preceding section.

EXAMPLES:

Liq. arsenicalis.
,, arsenici hydroch.
,, atropiæ.
,, ,, sulph.
,, epispasticus.

Liq. hydrarg. perchlor. (½ gr. in 1 oz.).
,, morph. acet.
,, ,, hydrochlor.
,, plumbi subacetatis.
,, sodæ arseniatis.
,, strychniæ.

7. Misturæ

Great variation in proportions.

8. Pilulæ . Variation from 1 (of active ingredient) in 2 (of mass) to 1 in 8. The average is 1 in 3 to 1 in 5.

EXAMPLES:

Pil. aloes Soc.	1 in 2.	Pil. hydrarg.	1 in 3.
,, cambogiæ comp. . .	1 ,, 6, nearly.	,, quiniæ	3 ,, 4.
,, ferri iodid.	1 ,, 3.	,, saponis co.	1 ,, 5 (opium).

9. Pulveres . The amount of the principal article is, in a given quantity of almost each powder, different. The more important are already given, under the respective heads of Antimony and Opium, in a former table.

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,, chloroformi . .	1 ,, 20.

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Syr. aurantii . .	1 in 8 (tinct.)	Syr. papaveris .	1 in 2½ (capsules).
,, limonis . .	1 ,, 2 (juice).	,, scillæ .	1 ,, 17.

12. Tincturæ . The chief tinctures may be classed as follows, from the ***nature*** of their principal ingredient, or the ***amount*** of active principle they contain in a given quantity.

The proportion of active ingredient in the whole is:—

(α) 1 in 2.	(β) 1 in 4.	(γ) 1 in 5.	(δ) 1 in 8.	(ε) 1 in 10.	(ζ) 1 in 13½.
Zingiber. fortior.	Ergotæ. Ferri perchlor (liquor).	Cinchon. flav.	*The greater number:* Aconiti. Colchic. sem. Digitalis. Hyoscyam. Jalapæ.	Benzoini comp. Cinchon. comp. Nuc. vomic. Rhei.	Opii.

(η) 1 in 20.	(θ) 1 in 40.	(ι) 1 in 60.	(κ) 1 in 80.	(λ) *Weak.*
Arnicæ. Belladon. Cannab. ind. (ext.)	Aloes. Iodi.	Quiniæ.	Cantharid. Cardam. co.	Lavand. comp. 1 in 213 (*oil*). Opii am., 1 in 100.

13. Unguenta Of various strengths. The strengths of the important ointments will be found in a preceding table, under the several heads of

Aconitia.
Antimony.
Atropia.
Cantharides.
Opium.
Hydrargyrum.
Plumbum.
Veratria.

The general strength is about 1 in 10 to 1 in 20; alkaloids, 8 gr. to 1 oz.

14. Vina . Of several different proportions, according to strength of active ingredients:—

Vin. antimon. . .	2 gr. to 1 fl. oz.	Vin. ipecac. . . .	1 to 20.
,, ferri cit. . .	8 ,, 1 ,,	,, opii . . .	1 ,, 20 (ext.)
,, quiniæ . .	1 ,, 1 ,,		

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These changes may be either—

(1) After some lapse of time, *i.e.*, a *gradual* chemical change; or

(2) Immediately, by decomposition, as on the mixing together of "incompatibles."

In both cases the student must have his knowledge of primary analysis at his fingers' ends: he must consider, of several articles to be made up together, whether they are likely to change their composition in a short time (1), or whether they are of incompatible nature, *i.s.*: reacting immediately (2) on each other.

(1) In this division of the subject we will give a few examples:—

Mixture.	*Change.*
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Tannic Acid and Silver Nitrate in Pills . .	Decomposition will ensue, with production of gallic acid and carbonic acid. The presence of the latter causes the pills to swell up in size and appearance.
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Sparkling Wines	These are good examples of the principle in question. Champagne effervesces from the presence of carbonic acid, but the wine does not contain carbonic acid at the time that it is bottled: it contains simply an excess of sugar. Now in the process of fermentation sugar changes to alcohol and carbonic acid; or rather the atoms forming the molecules of sugar split up, and form the above-named alcohol and carbonic acid. This process occurs in a bottle of champagne after bottling, and hence the presence of carbonic acid in the wine.

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Incompatibles.	*Reasons.*
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Tartarized Antimony; and most vegetable infusions and decoctions, as Catechu, Cinchona.	Vegetable astringents throw down antimony oxide as an insoluble precipitate.
Lead Acetate; and Citric Acid	Lead citrate is one of the few insoluble citrates.
,, ,, ,, Sulphuric Acid	Lead sulphate is a very insoluble precipitate.

SECT. VI.—Practical Dispensing—*continued.*

Incompatibles.	*Reasons.*
The Protosalts of Iron; and the Alkalies, as Potassium Oxide, Ammonia Sesquicarbonate (so called), or Ammonium Carbonate.	Owing to formation of insoluble peroxide; but the ammonium citrate and potassium tartrate are exceptions to this incompatibility.
Potassium Iodide; and Acids or Metallic Salts	Decomposition would ensue, owing to instability of the compounds.
Magnesium Sulphate; with Sodium Carbonate; but it is compatible with Sodium Bicarbonate.	A white precipitate of magnesium carbonate is formed in the first instance; in the second case, a *soluble* magnesium bicarbonate is produced.
Lead Acetate; with Sodium Phosphate or "tartarized Soda" .	A white precipitate in either instance.
Ammonium Carbonate; with Lime (calcium oxide) . . .	Formation of precipitate; but ammonium carbonate is compatible with magnesia (magnesium oxide).
Ammonium Chlorate, or Ammonia; with Magnesia . . .	
Magnesium Sulphate; and Potassium or Sodium Oxides, and their Carbonates.	White precipitate or cloudiness.
Lead Diacetate; with Alum, Borax	Decomposition of compound, and substitution of weaker by stronger acid.
Tartarized Iron; with Mucilage	
Strong Acids; with weaker Acids, as Carbonates, Acetates . .	
Zinc Sulphate; with Alkalies	
Tincture of Iron Perchloride; and Mucilage of Acacia . . .	Black iron tannate.
” ” ” ” tartarized Iron; with vegetable astringents	

The usual reactions in chemical analysis must be remembered; of course, what are used as reagents are of necessity incompatible with salts of the bases or acids which they precipitate: thus, the soluble salts of mercury are incompatible with potassium iodide; lead salts with soluble sulphates; and quinine or morphia with an ammoniacal preparation.

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Acidi tartarici ʒij
Acidi hydrocyan. med. gtt. xx
Aqua destil. aḍ ℥viij

M. Cap. coch. ij mag. 4tis vel 6tis horis.

Remark:

Here we have an example of the formation of an insoluble precipitate, the potassium bitartrate, or cream of tartar. If the *sodium* salt had been prescribed, this would not have occurred.

(β) ℞ Plumbi acetatis
Zinci sulphatis āā ℈ij
Aq. rosæ ℥vj

M. Ft. lotio, ter die injiciend.

Remark:

An insoluble sulphate of lead is formed and deposited; not desirable in an injection.

(γ) ℞ Sodæ bicarbon. ʒvj
Acid. hydrocyan. dil. ♏xxx
Syr. zingiberis ʒiij
Tinct. calumbæ ʒiij
Infus. gentian. co. ad ℥vj

Misce. Coch. j mag. bis in die sumend.

Remark:

This is an example of the modern folly of excessive concentration in mixtures. A portion of the salt here remains undissolved, owing to a large dose of soda in too little fluid.

(δ) ℞ Infus. rosæ ad ℥vj
Sodæ carbon. ʒij
Mag. sulph. ʒiv
Sp. am. arom. ʒij
M. Sumat. ¼ mane.

REMARK:

This mixture assumes a greenish colour, scarcely intended by the prescriber, owing to the action of the alkali on the red colouring matter of the roses; moreover, a dirty-coloured precipitate (mag. carb.) is thrown down.

(ε) ℞ Quiniæ disulph. gr. xxiv
Pot. bicarbon. ʒij
Pot. iodid. gr. xv
Tinct. card. co. ℥j
Sp. chloroform. ʒij
Mucilaginis acaciæ ℥j
Aquæ ad. ℥vj
M. Coch. ij mag. ante cibum. b. d.

REMARK:

An unphilosophical mixture. It becomes opaque and turbid; not only is the *mucilago acaciæ* very likely to decompose, but a mauve colour is produced by the action of the alkali on the colouring matter of the tinctures; at the same time there is a copious precipitate of a quinine salt, soluble in dilute sulphuric acid, but insoluble in excess of ammonia.

(ζ) ℞ Ferri et quiniæ cit. gr. xxiv
Ammon. sesquicarb. gr. xxx
Sodæ sesquicarb. ʒj
Chlorodyn. ʒjss
Mucilaginis ʒvi
Mist. camphor. ad ℥iv
M. Coch. j amp. ter die.

REMARK:

This is an example of an inelegant, dirty-looking, turbid mixture. It requires violent shaking, as the chlorodyne settles, in the course of twelve hours, on the sides of the vessel in which it is kept; it is a mixture the preparation of which would reflect no credit even on the most skilful manipulator.

In the preceding pages we have endeavoured to carry out, in some measure, our twofold object—assistance to the mind of the student; aid to the memory of the scientific worker:

"Indocti discant et ament meminisse periti."

Our special care has been to unfold, before the student's eye, the several subjects under consideration, in as orderly and systematic a manner as possible: and we cannot better conclude than in the eloquent words of that master in the art of teaching, Professor Tyndall: "Whether we see rightly or wrongly—whether our intellection be real or imaginary—it is of the utmost importance in science to aim at perfect clearness in the description of all that comes, or seems to come, within the range of the intellect. For if we are right, clearness of utterance forwards the cause of right; while, if we are wrong, it ensures the speedy correction of error." Truly indeed may we therefore affirm that the master-key which has ever opened wide the gates of knowledge is—System.

'Observe degree, priority, and place,
Insisture, course, proportion,
. . . .
. . in all line of order."—*Troilus and Cressida.*

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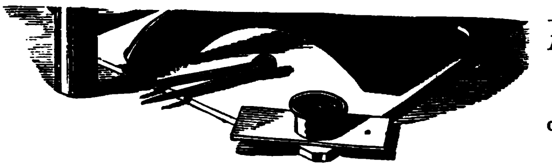

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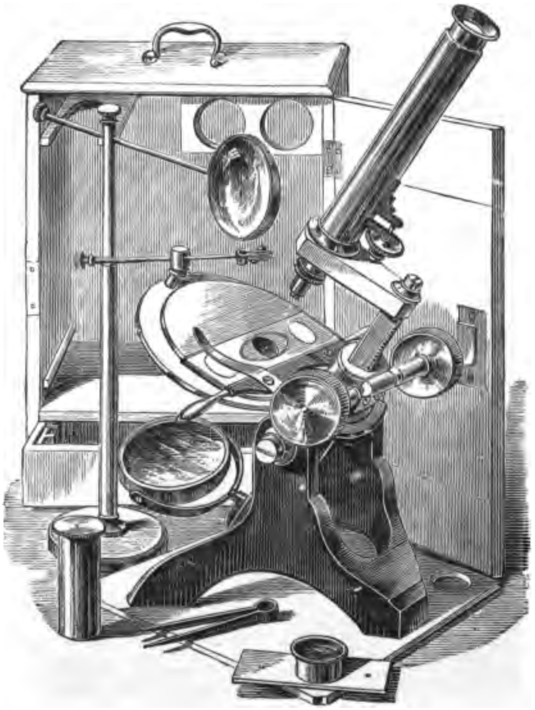

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